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ABSTRACT

A study was designed to evaluate the need for new labor market information and for methods of making better use of currently collected statistical and administrative data. The project was to demonstrate various information technologies which would improve the delivery of labor market information. Various computer models of labor market information systems were built to test out the possible uses of these systems by three state Employment Security agencies in Colorado, Michigan, and Wisconsin. Among the major research findings are: (1) a great need for computer programs which can aid in the summarization, tabulation, and analysis of labor market information; (2) the prototype information system MICRO was found to be the sort of system which can be used at modest cost to meet the need for rapid tabulation and analysis of labor market information; (3) procedures to forecast unemployment, universe of need for manpower services, supply and demand for labor can be automated at great potential saving to manpower analysts; (4) considerable cost savings can be achieved by centralizing computer software for retrieval analysis and forecasting; and (5) while better use can be made of administrative records, there are some data needs which can only be met by new data collection. (WCM)

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ON THE FEASIBILITY OF A LABOR MARKET INFORMATION SYSTEM

Volume I

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June 1974

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Randall Ruff, Research & Analysis, Colorado Division of Employment

Richard Seefer, Office of Planning & Evaluation

Samuel Stearn, Research & Statistics Division, Michigan Employment Security Commission

C. E. Christgau, Office of Research and Development, Manpower Administration

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CHAPTER ONE

SUMMARY, BACKGROUND AND MAJOR RECOMMENDATIONS

1.0 Summary

The Labor Market Information Systems Project (LMIS) was designed to evaluate the need for new labor market information and for methods of making better use of currently collected statistical and administrative data. The project was to demonstrate various information technologies which would improve the delivery of labor market information. These systems can aid in the design of a comprehensive labor market information system as called for by Section III of the new Comprehensive Employment and Training Act. The project built various computer prototypes of labor market information systems to test out the possible uses of these systems by three state Employment Security agencies: Colorado, Michigan and Wisconsin.

As prototypes these systems were built for a fraction of the cost of the full-scale models; however, they afford the opportunity to study the possible implications for similar full scale versions under certain assumptions. Labor market analysts often do not realize the potential of the computer and computer specialists often do not understand the complexities of user needs. Prototypes can bridge this gap and lead to improved delivery of labor market information services. Prototypes have also allowed us to evaluate potential improvements in labor market information delivery systems.

The prototype systems built during the project were all designed to improve the delivery of labor market information using existing data sources. The systems are of three types:

1) Systems which improve the access to information (including job placement and management information),
2) Systems which improve the quality of existing labor market information and
3) Systems which improve the manpower planning process.

The prototype systems built were:

1) Automated computer graphics to improve the reliability of existing information,
2) A computerized information retrieval system, MICRO, which permits non-computer specialists to directly access information from the computer,
3) A suggested procedure to re-estimate the number of persons needing manpower services,
4) A system to provide on-line access to manpower Employment Service automated records by remote terminal with daily updating used in job referral and placement,
5) Various methods of generating synthetic labor market information which is useful for planning, such as information generated by the LMIS SMSA supply and demand model,
6) A model to forecast unemployment insurance exhaustees, unemployment insurance claims and benefit payments for an area,
7) A data base useful for manpower planning using administrative data,
8) A directory of employers useful for job development and
9) A minority information data base useful for assessing the fraction of minority workers in an SMSA in a given occupation or industry.

1.1 Background

The prototypes built are focused on meeting current needs of the Manpower Administration. The basic assumption underlying the project is that better information can lead to better manpower programs.

The decentralization of manpower programs is placing continued demands on the Department of Labor to provide meaningful labor market information to manpower planners. The manpower planners could use their money to buy information services from groups outside of the Employment Service if the Employment Service is not responsive to their needs. Most research and analysis directors have staffs capable of meeting those needs However, most state agency computer operations are not set up to provide manpower planners with the level of detail they require. This problem becomes increasingly serious as the 1970 Census of Population

information becomes out-of-date. This is especially unfortunate in view of the administrative data generated by Employment Security agencies which could be helpful to manpower planners. The LMIS Project has designed prototypes to help state Employment Agencies to be more responsive to manpower planners.

The Manpower Administration spends close to $100 million dollars per year in information processing. This includes computer time for payroll, cost accounting, employment surveys, job banks and job placement as well as management reporting and analysis. It includes the cost of systems and programming staff as well as data input, coding and editing of information. Any activity of such a magnitude requires periodic review and research into methods for improving the activity. The LMIS Project reviewed some of these activities.

This report consists of five chapters and 13 appendices. Chapter 1 contains the introduction and major recommendations. Chapters 2 through 4 provide summaries of the various LMIS Projects. Chapter 2 deals with an LMIS project which constructed a prototype information retrieval system. Chapter 3 deals with projects which made use of this information retrieval system. Chapter 4 deals with LMIS models and projects which could improve the quality of labor market information. These chapters describe what was accomplished and what can now be used. They also evaluate the prototypes for use as full-scale systems. Chapter 5 discusses the major issues addressed in the entire project and makes recommendations for the future. The 13 appendices provide detailed descriptions of the various LMIS projects. Volume II contains supporting appendices for Chapter 4. Volume III contains supporting appendices for Chapters 2 and 3.

1.2 Research Findings

The research design of the project was to develop prototype information systems which could meet the needs of labor market information users. These prototypes were constructed for use in three state Employment Security agencies: Colorado, Michigan and Wisconsin. Information about construction of the large-scale systems, the benefits and costs of the large-scale systems and implementation problems was learned in the

construction of the prototypes. The major research findings are discussed in this section. These and other findings are discussed in more detail in chapters 2-4.

1) A forecasting model was constructed to forecast demand for labor by industry and supply of labor by age and sex. The model was tested for three SMSA's: Denver, Detroit and Milwaukee. The model translates national output changes by industry to SMSA employment changes. However we were unable to forecast employment in Denver significantly better than trend extrapolations. While supply forecasts look reasonable, we couldn't validate the patterns established by the model, since data generated by the model is only collected every ten years.

2) There is a great need for computer programs which can aid in the summarization, tabulation and analysis of labor market information. Existing procedures followed by most State Employment Agencies require specific programs to be written each time a new request for information is made. This process is costly, time-consuming and inefficient.

3) The prototype information system MICRO was found to be the sort of system which can be used at modest cost to meet the need for rapid tabulation and analysis of labor market information.

4) Procedures to forecast unemployment, universe of need for manpower services, supply and demand for labor can be automated at great potential saving to manpower analysts.

5) Considerable cost savings can be achieved by centralizing computer software for retrieval, analysis and forecasting. Each state can use a terminal to access programs to do these analyses and use minicomputers to transmit the data to regional centers. To export these prototypes to 50 states instead of a few regional centers would not be cost effective.

6) While better use can be made of administrative records, there are some data needs which can only be met by new data collection. These needs are discussed in Chapter 5.

1.3 Major Recommendations

The following summarizes the major recommendations developed in

this report:

1) If local manpower planners are to do any real planning and Employment Service personnel are to provide them with useful research and analysis information, there is a great need for training and for improved access to information. The ideal way to combine training with improved access to information is through regional information centers. These centers would bring together manpower planners, Employment Service personnel and academicians. The center would aid the Research and Analysis chiefs of the state Employment Services, especially in manpower planning. The states could have access to the center's computerized information by remote terminals. However, the states would continue to have computers for production functions, such as payment of unemployment checks. The centers would do research, training and provide public service. They would develop various tools of use to labor market analysts and manpower planners. We consider this our major recommendation. If it were implemented we feel that it could serve as an impetus for achieving most of our other recommendations. We would recommend setting up one new center and allocating resources to existing regional office computers such as the San Francisco Region. These centers should be budgeted for five-year periods to increase stability of staff and the centers' viability to achieve operational inroads. Such a plan could be expanded as the need arose to include other regions. While the cost of two such centers might be as high as $3 million a year, the centers might eventually save the Manpower Administration five times that amount over what computer and software costs might otherwise be. See Appendix G and Chapter 5, Section 5.5 for a detailed description of such a center.

2) Computer models can greatly improve the manpower planning process, especially if they are based on good data. For example, procedures such as estimating the number of persons in an SMSA who require manpower services under different assumptions with different characteristics could be computerized, which would greatly improve the meaningfulness of the estimates. The procedures presently used by the Manpower Administration for estimating persons needing manpower services were found to be inadequate.

3) Some survey information can be very expensive to collect and often is not needed for manpower planning. A synthetic data base can be created by a model which generates quarterly or yearly data in a systematic way. Chapter 4 outlines several such models.

4) Some new data is required to fill data gaps which cannot be met economically by any of the procedures investigated in the study. Eight such gaps are discussed in Chapter 5, Section 5.4.

5) For on-line information retrieval systems to show improvements in reduced cost per placement, increased placements or improved quality of placements there are important prerequisites: a) The job orders received by the Employment Service must be adequate to permit placement, b) Employment Service personnel must be adequately trained and c) the right goals, incentives and motivation must be offered to Employment Service personnel to make quality placements. Over-emphasis on the number of placements will de-emphasize quality placements. Emphasis on counseling special groups, while socially desirable, can lead to reductions in measured quantity of placements. Frequent changes in goals can lead to chaos.

These prerequisites are more important than on-line retrieval systems for placing applicants. Without them, on-line systems will probably make little difference. See the discussion in Chapter 3, Section 3.2.

6) Computers can be used more effectively to improve the functioning of other Employment Service placement functions. For example, computers can be used for employer development to increase job orders placed at the Employment Service. (See the discussion in Chapter 3, Section 3.3.) Computers can be used to store training opportunities available for applicants as well as other supplementary labor market information.

7) Analysts, planners and managers in the manpower field are frustrated by the inability to access information already collected. This barrier can be overcome with improved computer software which minimizes the time required to convert data into information. The emphasis must shift from preparing reports to designing and managing data bases. However, unless training is provided to the analyst, the manager, and the programmer, this potential will not be realized.

8) As concern shifts from one-time reports to data bases and data base management, resources should be invested in improving data quality. Computerized techniques like computer plotting or automated benchmarking should be employed. In some cases, vast improvements can be made at little or no cost by using these techniques, and perhaps even some savings over manual procedures can be made. Often however, the manual procedures are so costly and laborious that they are not done at all. See, for example, the discussion on benchmarking in Chapter 3, Section 3.5, and Appendices E and F.

CHAPTER TWO

A FLEXIBLE DATA RETRIEVAL SYSTEM

2.0 Introduction

Labor market information is needed by job seekers entering the labor market for the first time or planning a career, unemployed workers or workers changing jobs, employers looking for workers and employers deciding where to locate a plant or what wage to pay. Managers of government programs require labor market information to plan, evaluate and monitor their programs.

Despite large expenditures on labor market information, users have a very hard time obtaining information in the form they need. Vast improvements are being made by organizations providing census information to users, but there is a need to provide similar assistance to users of other types of labor market information.

The LMIS Project worked with three state Employment Services, Colorado, Michigan and Wisconsin, to develop ways of making labor market information more readily available for use by the various labor market information users. The emphasis in the LMIS Project was not on what information might be gathered in an ideal information system, but on how existing administrative and statistical information could be used to meet the needs of users.

This chapter discusses MICRO, a prototype information retrieval system, which can be used to meet various needs of users of labor market information including job placement research and analysis and management of Manpower Programs.

2.1 MICRO Information Retrieval System

The traditional way to implement a retrieval system has been to determine what questions are to be asked of the data and then to write a program and structure data to answer these questions. However, often it is not known in advance what questions will be posed; nor are the data in a particular format to deal with this problem. The LMIS Project looked into ways of designing a system which would make it possible for users of information to pose questions using a data base without

the aid of a computer programmer. This need is recognized by Yavitz:

> It is important to distinguish between the published standard reports and the data base from which they are generated. One of the major contributions of the computer, aside from its high speed and capacity, has been its ability to divorce report publications format from the data collection and storage.
>
> With this new capacity at hand, an information system can deliver a whole range of outputs. At one extreme of this range is the ability to produce standardized reports and summaries on a pre-determined and repetitive basis. At the other extreme, the information system can deliver specific responses to particular requests and deal with different users' problems that are nonrepetitive, non-standard for all users or unanticipated in nature.[1]

MICRO is an interactive information retrieval system which consists of a series of interrelated computer programs linked into a system. Although it is primarily used to ask nonstandard questions, it can also function to produce standardized reports. The system is designed to search a series of cases (a data set) and "find" all of the cases (if any) that meet certain specified criteria. In finding a set of cases the system makes a second copy of them (forming a new data set) while leaving the original data set unchanged. At this point subsequent searches may be performed on the new set.

The user typically initiates operation of MICRO from a remote terminal which communicates with the computer at The University of Michigan or Wayne State University. The system is command-oriented and the user may issue any of about 25 different commands. MICRO will then perform the operation and request a new command from the user. A system which operates by carrying on a conversation with the user is called an interactive system.

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[1] Yavitz and Morse [22] p. 102.

The MICRO representation of the data can be visualized as a matrix in which the rows represent different records or "cases" and the columns are fields in which characteristics for each case are recorded; the actual data representation is in set-theoretic form.[2] In labor market applications the rows typically represent job applicants or employers and the columns (called "fields") designate fields such as age, sex and income or type of industry, number of employees and payroll. Each field can have certain categories which stand for different values of that field. For example, the field SEX would have the categories MALE and FEMALE.

A set-theoretic based system enables the user to perform a search on any of the fields in the data set.[3] The set-theoretic approach also allows great flexibility in the retrieval operations. Four of the major retrieval operations are FIND, XTAB (cross-tabulation), SELECT and RESTRICT. All of these operations result in the formation of a RESULT set, i.e., a subset of the original set. This RESULT set can be renamed by the use of the NAME command and can either be further manipulated or stored, temporarily or permanently.

The FIND command extracts a subset of cases in the data base by matching specified category information under a specified field or fields. The resulting subset consists of selected rows of the data set.

After finding the RESULT subset, MICRO stores the subset temporarily and prints out a count of the selected cases, i.e., the number of cases whose category values under the specified field conform to the logical combination designated in the FIND command.

The SELECT command selects a subset by picking out specified fields in all records. The RESTRICT command is usually used to match records between two different data sets. Both data sets will have fields that match for corresponding records.

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[2] See Appendix H, A Set Theoretic Data Structure and Retrieval Language.

[3] This system is in contrast to a hierarchical structure in which all records in a data base do not contain the same set of fields, thus making some searches very efficient and other searches very inefficient or even impossible.

Other MICRO commands allow the user to SAVE a RESULT set permanently for future reference, to PRINT all or part of a data set, to DESTROY data sets that will no longer be used and to ask for documentation about the contents of data sets as well as the MICRO commands themselves. Another command allows the user to call an external subroutine. Therefore, all of the data in MICRO data sets is available for functions not available in MICRO. This is very useful for standardized report writing, certain statistical packages and other standard programs.

Another advantage of MICRO is the structure of the commands themselves (the syntax). The structure of the commands greatly resembles English, thus making them easy to learn and to use. This also tends to reduce the fear which most non-technically trained people have about using computer systems. MICRO also has the ability to enable several commands to be executed automatically by defining a single new command. When the new command, called a macro, is given, the entire series of commands is executed. Macros provide a great deal of flexibility and are a convenient method of extending the system at very low programming cost.

MICRO enables the user to make computer searches in minutes which might take weeks or even months by conventional methods. If the user discovers interesting or unexpected results from an initial inquiry, he is able to pursue these further. Also, it is much easier to discover errors in data when using such a system.

MICRO, however, is not without its shortcomings. Perhaps the most limiting disadvantage lies in the fact that MICRO is presently dependent on an IBM 360/67 computer which is operating under the Michigan Terminal System (MTS).[4]

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[4] That is, MICRO is programmed in IBM/360 assembler language and depends upon some MTS system routines and the virtual memory inherent to the system. MICRO also uses some routines written and owned by Set Theoretic Information Systems Corporation (STIS) of Ann Arbor. These routines are part of a proprietary software package called Set Theoretic Data Structures (STDS). These routines use extended set theory to manipulate the data. The reasons for using a proprietary software were primarily economic since STIS is providing the routines free, for unlimited use on the Michigan/Wayne State Computers.

MICRO, when it was originally designed, was much smaller and has evolved with time. Because of this evolution, modifications, extensions and debugging have become expensive.[5]

The benefits of a MICRO-type language are discussed in other sections of this chapter as various applications are presented. The operational costs of using MICRO depend on the applications and the size of the data bases used. Various applications of the system are described and evaluated in Chapter 3.

One design change would be to further modularize the system. That is, by breaking MICRO into more "component parts," any given part--or module-- could be redesigned as needed and reinserted into the system without necessitating the redesigning of the total system. As noted previously, MICRO as it is currently designed and programmed will run only on the University of Michigan or Wayne State University computer. The costs of extending MICRO to other computers and operating systems is discussed in Section 2.3. The cost ranges from $250,000 to $1,000,000 depending on the options chosen.

2.2 Criteria Relevant to Data Retrieval Systems

The decision whether to choose any general purpose information management systems, such as MICRO or commercial alternatives, involves many strategic questions that can only be resolved by a clear statement of agency goals. An information system must be tailored to the objectives and operational style of the organization which uses it. We used the MICRO Information Retrieval System as a prototype for such a system.

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[5] When an information system grows in this way, the cost of maintenance and changes to the program become more expensive as the size of the program increases. To prevent this problem such systems can be modularized or broken into component parts or modules for easier debugging and documentation.

References in the text to MICRO should be taken to mean MICRO or its equivalent. The following are some questions for evaluating different systems:

1) Should access to information stored on the computer be allowed directly to data analysts or just computer programmers? For the former, user-oriented software is required. This eliminates the bottleneck of translating the request to a data processing manager who may filter the request through several people before the job is done. General inquiry systems exist which reduce the need to write a new program for every request. Most of these programs, however, require programmers. MICRO-like systems are appropriate to a user-access philosophy, where programmers are an optional buffer, while the traditional systems force programmers to be a buffer. With MICRO, programmers prepare data bases and computer commands for users.

2) What is the size of the data base to be accessed? How often is the data base accessed? A commitment to a large investment in data base generation, editing, analysis and retrieval capabilities is usually justified in two circumstances: (a) Where there is a fairly high volume of use and therefore the average cost per inquiry is low; (b) Where there is a need for rapid, accurate information to make decisions. While the first reason is the more common justification, the system could pay for itself if it provided data that saved the agency from one bad decision. The choice of a MICRO-like system will not automatically mean that people in the organization will use its capabilities. An information center may be needed to train users in the capabilities of such a system.

3) Should the organization have a batch and on-line computer system or a batch-only computer system? The latest generation of hardware and software in computer technology lends itself to time-sharing and on-line applications as an addition to batch-processing. A batch-only computer shop cannot provide a full range of information services, but is less expensive. MICRO can function in a batch environment, but the concept of flexible inquiry by users is more akin to on-line systems. The latter is of value to analysts and managers in many ways. Choices such as this are often made by default in an agency, because planning for labor market information needs is often not done. User information needs often are not reflected in the choice of computer systems.

4) How easy is the system to learn? Systems can be designed to resemble English, and to prompt the user when he makes a mistake or they can be rigid, working improperly if the user makes a mistake.

5) How dependent is the information system software on the structure of the computer hardware configuration? At this moment, MICRO is tied to The University of Michigan's IBM 360/67 computer operating under the Michigan Terminal System (MTS). It was relatively inexpensive to design, construct and implement the system at Michigan for purposes of a feasibility study. About 20% of the project resources went into the development of MICRO over a four year period. But an element in the choice of any system is the ease with which it can be transferred to a new locale, or to a different brand of computer. MICRO could be adapted, generalized and transferred at a cost of $250,000 to $1,000,000 based on sophistication and transferability of the ultimate system. While this is not cheap, it is minor compared to the costs of ESARS. If the concept of a Regional Manpower Information Center was adopted, one could conceivably adapt MICRO to immediate use by acquiring an IBM 360/67.

6) How committed is the organization to a policy of systematic data-base management? The assumption that organizational resources guarantee the quality, the integrity, and the thoughtful evolution of the whole range of data bases to be used is implicit in the claims of relative efficiency of modern systems such as MICRO. If basic validation problems (such as those that plague ESARS) at the level of encoding of data or of definitions of variables persist, no information management system will reach its potential (although MICRO could be used to help detect errors and to edit and update files). Similarly, if an agency does not allocate some personnel to implement the optimal structuring of data files to make updates and frequent inquiry-types more economical, then the efficiency gains permitted by a MICRO-like system will not be realized automatically.

7) Will the same computer system be used for research and analysis, management information and production runs (e.g., paying checks)? The allocation of computer time to various kinds of processing should be a matter of rational priority setting, but often forces unstructured inquiries for research and management information back to the end of the queue. MICRO-like systems must have a fair share of resources (in computer time, storage, programmers, etc.) at a given installation in order to be useful. This is especially true of batch-oriented systems,

where turnaround is slow and where programmer time is already heavily committed to pre-existing programs. On the other hand, it often happens that a particular kind of generalized software finds application in only a narrow range of activities. If it cannot come into general use because of resistances to change within the organization, then the system will not pay off. Again, one solution to these kinds of problems is to effect dissemination via new regional centers that service states with a variety of information and services. This would require less tooling-up by states and less jostling for change within existing organizations. Production systems would be identified with states, and much research planning and management information could be serviced by the regional centers. Without this, bringing MICRO into every state, large and small, would involve a tremendous dissemination cost.

8) How flexible is the system to meet changing needs of users in terms of: a) new data bases, b) new inquiries or c) new software capabilities? In general, MICRO-like systems cost less to adapt than traditional systems for new data bases and charging user inquiry patterns. They were designed to do it. On the other hand, some kinds of changes in software capabilities could prove to be relatively expensive to implement, in order to preserve the generality of the system.

9) What provisions does the system make for security of data? In general, MICRO-like systems are better able to handle security than are traditional systems. The use of remote access via time-sharing means that tapes remain in a safe central location, while passwords and scrambling of files provide satisfactory protection against unauthorized access. As security and confidentiality of files assumes greater importance, the new software technologies show their worth.

10) How do costs vary at different levels of load on the system, in terms of: a) size of data base, b) frequency of inquiries, and c) number of other users on the system in a time-sharing multi-programming environment? Managers who have small data bases, infrequent inquiries and few users seldom need MICRO-like systems. The design concept built into the foundations of MICRO is that as the size of data bases increases arithmetically, the costs of queries should also rise, at worst, arithmetically.

In some traditional systems costs rise at a geometric rate. In some instances increases in data base size do not increase the cost of MICRO retrieval. MICRO is the kind of system that permits frequent inquiries, while traditional systems overload much more rapidly, especially at the programming end. Since MICRO tends to be for large data bases, the presence of several users, each with large MICRO data sets, has the capability of paralyzing any computer now in existence. MICRO is basically a "big computer" type of system. It can require large amounts of core for data and programs, which tends to strongly limit the number of different MICRO users at one time on all but the largest systems. However, the system could be designed to permit the users to share the common data base at the same time or to reduce the overhead each user presently requires.

2.3 Costs of Adaptation of MICRO to Manpower Administration Use

The economics of MICRO use have been described, but they are not the same as the economics of dissemination. Dissemination involves a series of choices for the further development of MICRO for use outside The University of Michigan environment. A policy decision made by the Manpower Administration early in the project was to minimize development costs of MICRO even if this meant limiting transferability. This was done in two ways: first, MICRO takes advantage of many routines which were available free but function only at The University of Michigan on the IBM 360/67 under a sophisticated time-sharing system (MTS). Second, many proprietary software routines were made available free from a private software company. The Manpower Administration now faces the following choices:

1) Extend MICRO in four levels:
   a) do nothing except maintain it
   b) extend and modularize its capabilities under the existing computer system
   c) adapt it to a non-MTS operating system on IBM hardware
   d) adapt it to another make of computer
2) Export of MICRO in two levels:
   a) keep it at University of Michigan for experimental work
   b) transfer it and all documentation and training in use and maintenance to a new organization.

3) Use another system to accomplish the same objectives as MICRO.

If further use is to be made of MICRO the following figure illustrates the alternatives:

Figure 1 Future MICRO Development Alternatives

STATUS	HARDWARE/OPERATING SYSTEM: Model 360/67 IBM/MTS	Large IBM/non-MTS	non-IBM/other
No Change	Option 1		
Modularization/ Expansion	Option 2	Option 3	Option 4

Option 1 is available at no cost except further MICRO maintenance at $2,000 per month. MICRO would be available for further experimental use, and at limited further cost, could be extended for new experiments. Maintenance includes altering the system as necessitated by changes in the dynamic operating systems and correcting bugs as new uses are attempted.

Option 2 calls for the modularization of MICRO's code (i.e., breaking it up into small, manageable sections to facilitate documentation, maintenance and modification) and for the extension of MICRO's capability for ease of use, more internal efficiency, ability to handle very large data sets and the like. It presupposes an IBM/MTS computer configuration. Costs would range from $50,000 to $200,000 depending on the extensions chosen.

Option 3 requires a change in MICRO to permit it to operate in a standard IBM operating system. It would be a way of generalizing and exporting the software to make it accessible to more environments and to more applications. Costs would be $250,000 to $750,000 for everything, including Option 2.

Option 4 would be to fully generalize MICRO to operate on some other brand of computer - possibly with some very general underlying code. It would include most of Options 1-3. Costs would be $500,000 to $1,000,000, including Options 2 and 3.

These options must be considered to be the normal sequence and costs for technology transfer from a university research environment to the operational world of an agency like the Manpower Administration. Simply attempting to export MICRO as is to state employment agencies would be far less efficient than a transfer of MICRO to a Regional Manpower Information Service (see next chapter). Some degree of analytic sophistication will ultimately be necessary for an agency to successfully take advantage of the potential uses of MICRO for an integrated LMIS. Alternatively if MICRO has demonstrated the need for a general retrieval language, the Manpower Administration might issue an RFP to vendors which could meet Manpower Administration specifications. If the Manpower Administration didn't need to own the retrieval language, proprietary software houses could provide a package at substantially reduced cost in the short run.

2.4 Summary

A flexible data retrieval language, called MICRO, was developed as a prototype to show how various needs of labor market information users could be met.

The MICRO system allows a user to pose questions to the computer in English and receive information from a data file without the intervention of a programmer.

Several questions were raised for deciding upon the need for a system like MICRO such as the desirability of eliminating programming bottlenecks, size of data base, training time, ability to use another computer, requirements for a flexible system, data security and cost considerations.

CHAPTER THREE

DATA ACCESS AND QUALITY

3.0 Introduction

This chapter discusses uses which were made of the prototype information system, MICRO, described in Chapter 2 and prototype information systems which can be used to improve data quality in Employment Services or other manpower agencies.

Three prototypes dealt primarily with data access: how data should be represented to manpower personnel and what the mechanics of making inquiries should be. In the first prototype of this chapter, the use of MICRO for an on-line real-time computer aid to job placement counseling was tried at the Denver Youth Opportunity Center. This was an examination of the use of sophisticated access methods, the nature of data needed by counselors and the use of data updates to the Job Bank via long-distance transmissions via key-to-disk computer linkage. By contrast, in the second prototype, the use of MICRO by the Wisconsin State Employment Service dealt with problems of relating different data sets and with the problems of getting a representative conventional analyst of a state agency's Research and Analysis staff to independently use MICRO to access and analyze data. The third prototype was the computerization of Denver job orders placed by the Employment Service in 1971 and 1972. This data base can be used in the Employment Service employer relations program to suggest possible areas to make employer contacts and to provide supplementary job information to applicants who cannot find jobs in the current job bank.

Two prototypes deal with data quality. One prototype was the use of a CALCOMP plotter to automate plotting for benchmarking procedures -- a simple way of identifying data errors and reviewing "handwork" from a manual process. The other prototype suggested how econometric methods could be used to spot probable data errors.

3.1 Data Bases

Eight major data bases were used in the prototype labor market information system at the MICRO level and are discussed in more detail

in Appendix J. MICRO data provides data on firms, individuals and for very detailed tabulations. The MICRO data bases were:

1) ES202 - A quarterly report on employment and payrolls of firms covered by unemployment insurance. Data was inputted on an irregular basis for all three SMSA's (Denver, Milwaukee and Detroit).
2) ESARS - The Employment Service Automated Record System. This included job orders placed by employers and job applications of workers seeking jobs registered at the Employment Service. Data was inputted on an irregular basis for all three SMSA's.
3) Social Security Continuous Work History Sample - Characteristics of a 1% sample of workers employed in industries covered by Social Security in all three states (Michigan, Colorado and Wisconsin) for 1960, 1965, 1970 and 1971.
4) Census of Population 1970 - A 2% sample of the population (the two 1% public use samples for all three SMSA's).
5) Current Population Survey - Detailed information on income, work experience and employment of a 0.1% sample of the population obtained by a household survey. National data was obtained, but only Wisconsin data was included in the prototype.
6) EEO-1 - A survey of employment by occupation by sex, and occupation by race for the three SMSA's for 1969 and 1970.
7) ES203 - Characteristics of the insured unemployed. A sample of persons covered by unemployment insurance programs for Wisconsin.
8) Job Bank System - This included information on job orders, referrals and services rendered for Denver and was updated daily.

By integrating the Census data and more recent and selective information, more timely local information becomes available. The Census of Population (4) can be used as a benchmark which can be extended for local needs by the use of administrative records (1, 2, 3, 6, 7, 8) and by expanding a few special survey samples (5).

Some data series such as the BLS Labor Turnover (DL 1219) and the Current Employment Statistics series (BLS 790) were used in the labor market model (see Chapter 4, Section 4.1) but not in the prototype labor market information system since MICRO data could not be obtained for these series due to confidentiality restrictions.

Other sources of labor market information are discussed in Appendix L.

3.2 Computerized Aid to Counseling

A project was undertaken at the Denver Youth Opportunity Center (YOC) to test the feasibility of Employment Service Counselors using an on-line real-time information retrieval system to aid Employment Service placement efforts. The project relied primarily on data already automated by the Colorado Job Bank and the Employment Service Automated Record System (ESARS). An objective of the project was to determine the feasibility of transmitting this data to a remote location and access the data by remote terminal using a general purpose retrieval language. The extent of counselor acceptance of the system was unknown and technological and behavioral barriers were unknown. The feasibility study showed these barriers could be overcome.

It should be emphasized that the counselors at YOC were not performing a computerized job match; they were making a computerized job or applicant search. The counselor decides which job characteristics are most important for each applicant (such as location of job, pay, etc.) and the priority of ranking is also made by the counselor. These factors are not preset in the computer and the counselor can easily create a different ranking or selection of job characteristics during an interactive session, as required by the availability of jobs that day, to meet the needs of both the applicant and the employer.

Initial analysis of information requirements at the Youth Opportunity Center revealed that additional or better information was required in three areas (in order of priority):

1) Job information,
2) Applicant or client information,
3) Local office activity and productivity information.

Each night information from the Colorado Division of Employment was transmitted from Denver via the Division's Mohawk Data System

key-to-disk computer over a foreign exchange line to the Wayne State University Computing and Data Processing Center in Detroit.[1] Each night this data was processed automatically by the Colorado Update System written by LMIS Project staff. After processing, the data was then available for access by the staff at the Denver YOC using the MICRO Information Retrieval System Language and a remote dial-up terminal. An evaluation of the experiment based on a questionnaire is described in this section. A current LMIS Project is measuring the impact of the system using control and experimental local offices in Colorado.

Training in the use of the language was to begin in the spring of 1973, but numerous delays in the availability of the foreign exchange line and in the ability of the Mohawk Data System Computer to transmit data postponed training until July. The staff was given three weeks of very intensive training, each person receiving at least three sessions of instruction, each an hour to an hour-and-a-half in length. The last session was on a one-to-one basis between counselor and instructor and was predominantly on-line real-time practice using MICRO. The anticipated psychological barrier to a technological innovation was minimal. That is, most staff members seemed to have little trouble in learning the basics of using MICRO. The next step then was to see if the staff could be motivated to use the information retrieval system.

During the project, the counselors at YOC were the primary users of the system. Counselors at YOC are highly educated (30 hours beyond a Bachelor's degree) and relatively young. The degree to which they used this system was dependent on several factors:

1) The timeliness of the information,
2) The availability of the computer system,
3) The response time of the information system,
4) The availability of the terminal,
5) The availability of the foreign exchange line to Detroit.

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[1] The foreign exchange line is a special purpose line rented from the telephone company which treats Denver calls to the Wayne State University computer as local Denver calls.

The timeliness of the data proved to be the greatest problem during the duration of the experiment. Counselors said they needed information updated daily because of frequent changes in job orders which would be otherwise out-of-date. The information could not be updated every night at the start of the experiment due to technical difficulties. These difficulties can be divided into three areas: first, inconsistency in transmission attempts from Denver; second, disturbances ("noise") on the telephone line; and third, reception problems at the Wayne State University Computing Center. Transmissions from Denver were attempted regularly beginning in August. The problem with the telephone lines was corrected in early October with the direct hookup of the Mohawk Data System to the foreign exchange line. The problem with reception at Wayne State University was corrected in late October. Thus, at the conclusion of the experiment the Job Bank information was consistently up-to-date Tuesday through Friday. Monday morning updates could not be completed until Tuesday morning because of scheduling problems at the Colorado Division of Employment.

During the duration of the project, the computer system at Wayne State University underwent several major changes. These changes disrupted the early months of the experiment. The experiment was also late in starting due to priority problems at the Colorado Division of Employment.

Response time depends upon the number of users of the Wayne State computer at any one time. During certain hours of the day the computer is used more heavily than others. Counselors at YOC usually attempted to use MICRO during the non-peak hours. There were times when the system became overloaded to the extent that response time was unacceptable to the counselors. The modal response of the counselors according to the second questionnaire was that a response time exceeding five minutes was unacceptable.

One terminal was made available at YOC. It was capable of printing up to six copies at thirty characters per second. Since there was only one terminal, if one staff member was using the terminal others had to wait their turn. There are many instances in which counselors could not use the terminal because it was busy.

When all of the technological problems have been overcome and the information is available for access by staff members the issue of usage is primarily one of counselor motivation.

Whether a staff member will be motivated to use the system also depends on the goals and directives of the Employment Service. If the Employment Service encourages counselors or interviewers to be concerned about the quality of the referrals made and suitability of the applicant-employer match, then an on-line real-time system can be of significant benefit. Although staff members may not be spending any less time with each applicant, a MICRO-like tool can give the applicant more and better information. One counselor at YOC noted a particularly positive response to jobs he found through MICRO -- more of his counselees actually reported to their jobs. Another counselor mentioned that MICRO could be a good educational tool by showing the applicant whether his demands are realistic.

The current emphasis at the Colorado Division of Employment, as perceived by the counselors at YOC, is quantitative rather than qualitative. That is, next year's budget will be based upon the number of placements per month and, therefore, guides current and future YOC staffing levels. This attitude discourages looking for a near-optimal job applicant match and encourages sending applicants to the first job opening that minimally meets the employer's and employee's needs. Both the applicant and the employer suffer. The applicant may not remain on the job, a fact somewhat indirectly encouraged by the Employment Service quotas, where a person placed six different times in a year is worth nearly six times the credit of that individual placed in one job for the entire year. With this emphasis, very little benefit can come from a superior method of accessing information.

Charles Holt [8, p. IV12-14] of the Urban Institute recommends:

> In order to crystalize the objectives to be pursued by the Employment Service and to reward performance in meeting these objectives, salaries, promotions, and office evaluations should be geared to practical measurements that reflect national economic objectives.
>
> The staff [counselors, etc.] ... should be rewarded for making placements quickly but credit should be weighted by the duration of employment tenure that followed. Additional credit should be given for service to disadvantaged groups, individual workers with already long

duration unemployment, and for upgrading the incomes of low-income workers.

Referrals to employment related services should also be rewarded as they contribute to these same objectives. [...]

Since placements would be weighted by employment tenure, the counselor could afford to take more time to find the right long-term job for a worker and not simply be concerned with making fast placements. Since tenure could be shortened by employer dissatisfaction, the counselor should also pay attention to employer needs as well as those of workers. [...]

The purpose of the incentive system would be to reward the counselor for doing the kind of job that is needed to be done. By proper rewards his efforts to improve his performance would contribute to the effectiveness of the system.

To the extent that an on-line information system could permit much more sophisticated management evaluation of counselor performance, it might have a major impact on improving placement quality. For example, managers could evaluate counselors on Holt's [8] more sophisticated incentive system, rather than just on the number of placements. It was not possible for us to alter incentives placed on the local office during the period of the experiment, however. Unfortunately, the period of experimentation at YOC was one in which increasing pressures (quotas, layoffs, etc.) influenced the counselors.

Two questionnaires were given at YOC, the first prior to any on-line activity and the second in November. All of the YOC employees answered the questionnaires. The first questionnaire indicated that only 16.2% had ever used a computer terminal and that 45.9% felt that the use of a computerized aid for labor market information would increase effectiveness and efficiency of counselors in performing their duties. The second questionnaire in November indicated the following:

-90% of the staff think that a MICRO-like system is useful as a tool in the local office;

-87.5% of the staff want the terminal to remain in the YOC office;

-75% of the counselors who responded felt that the system moderately or greatly decreased the time needed to do a job search;

-75% of the counselors felt that MICRO performed a better search than they would have been able to perform manually; and

-Almost 70% of the staff members found it "easy" or "fairly easy" to learn to use MICRO.

Counselors felt that the capability of MICRO to sort through the outdated and erroneous jobs in the Job Bank was very useful. Many counselors felt that they would have a better chance of making a referral and eventually a placement if the order was new or relatively "young." Because the selection of available jobs could be restricted in terms of the date that the job order was written, a counselor could scan the data set for only the most recent jobs that met an applicant's personal requirements. This type of activity would lead to more referrals on the first and second day after the job order was received.

The November questionnaire also indicated that the counselors' chief complaints about the system were:

1) updating problems;
2) system "down time," (both of which were resolved by the end of the testing period) and
3) having to wait too long to use the terminal since there was only one in the office.

During a discussion of the first questionnaire with YOC counselor and support staff, their strongest recommendation was for increased employer-Employment Service relations through:

1) qualified, trained and informed job solicitors;
2) treatment of job soliciting as a high priority item and not something to be done in counselors' spare time (if there is any); and
3) follow-ups with employers to see if their needs are being met, what additional services they might require, etc.

These recommendations support Ullman and Huber [19, p. 33]: "Agencies should be encouraged to maintain an adequate employer relations effort."

The project was not designed to measure the effect of the MICRO Information Retrieval System on the quality of placements, as several factors would have made this determination impossible:

1) a large reduction in staff during the experimentation period;
2) the unavailability of a comparable office for use as a control;

3) lack of time and budget allowance for following up applicants; and

4) the necessity of debugging the technological and human relations problems of the computer system before testing the system in a controlled environment.

The quality of placements, i.e., the degree to which the needs of an applicant and an employer are met, is a critical evaluation criterion. As indicated previously, the feeling during these belt-tightening times is to emphasize quantity. Holt [8, IV-26] states:

> The tendency of easier placements to cause increased labor turnover should be noted. That is why it is <u>essential</u> to increase the quality of placements at the same time.

In the highly critical study of Job Bank by Ullman and Huber [21], none of their measures of performance to determine the effectiveness of the system included a test on the long-term success of placement activity. A study of placed clients might reveal that the quality of placements (as indicated by duration of employment, dollars earned, etc.) might be better under a good job/applicant information system. The addition of a computerized tool such as MICRO to retrieve Job Bank data may result in the same conclusions as those stated by Ullman and Huber, when evaluated under their criteria. The addition of an advanced data processing technique will not magically lead to the fulfillment of Employment Service quantitative placement goals--goals that could not be met with a manual system. As long as the Employment Service emphasis is merely quantitative, the success of the whole placement activity may be in jeopardy.

A current Manpower Administration budget procedure theoretically takes account of quality. This procedure, called the balanced payment formula [21], weights the budget allocation by 30% for quantity of placements, 30% for quality of placements and 40% for all other Employment Service functions combined such as labor market information.

This new procedure in principle recognizes the need to acknowledge qualitative as well as quantitative measures of job placement by weighting them equally.

The procedure has a few problems, however. Weights for quality of placement are based in part on the number of days the employer requests an applicant. If the employer requests an applicant for 150 or more days, the local office making the placement gets full credit for a long duration placement (5% of the total weight) even if the individual placed quits after 10 days. This problem could be minimized if a sample of placements was audited to determine the actual length of time worked by applicants placed, not the length of time an employer requests on the initial job order and if the weight for duration were substantially increased.

Another problem with the emphasis on quantitative measures of performance is the danger that activities may be eliminated which may be productive but not have clearly measurable outcomes.

Even if a tool such as MICRO were placed in a wide variety of Employment Service offices, an improvement in the quality of placements is unlikely unless Holt's [8] suggestions on setting quality as a more important goal is adopted, thus giving counselors an incentive to use the system. This may require additional employer development efforts, such as a follow-up evaluation program. Setting qualitative goals may help but is still not enough unless there are adequate jobs available in the Job Bank. The computer can be used to aid counselors in job development as discussed in the next section. During periods when the economy is depressed, even intensive job development efforts may not increase job orders.

In conclusion, the computerized aid to counseling -- MICRO -- was accepted as a useful tool by most YOC staff. On-line real-time access can be handled by local office personnel. Counselors felt that additional pertinent data-items should be collected for use when on-line capabilities are provided. The benefit/cost of such activity can only be evaluated in terms of Employment Service objectives, which at this time seem to be very heavily oriented toward the quantity of placements rather than on their quality. There is some question as to whether on-line placement alone will increase the quantity of placements. Recent Employment Service evaluations of job matching systems show dramatic increases in placements. But are these increases due to the computer,

the change in orientation of the Employment Service goals or changes in the economy?

3.2.1 Benefits

1) Examination of the behavior of counselors in job placement suggests that they used more criteria for job searches, so that the process became more sophisticated. Previously counselors relied on the DOT occupational code as the sole search key. Job search as under MICRO typically used multiple criteria. Counselors felt they were being more productive at their jobs and that a better quality placement occurred.

2) The use of MICRO for accessing files led the counselors to use data they had been inputting into the system. For the first time they had motivation to have high quality data input, so data reliability improved.

3) Experience and comments of counselors in using MICRO at YOC strongly suggest that it is easy to train people to use MICRO as a computer language. At other offices it may be necessary to give counselors more training to make "optimal" use of MICRO to improve the job search process.

3.2.2 Costs

Chapter 2, Sections 2.2 and 2.3 discuss general cost considerations of an information system. This discussion is applicable to this experiment.

3.3 Directory of Employers

A computerized Directory of Employers was prepared for use in job solicitation and job development at the local Employment Service office level. The directories have been prepared with the Denver Youth Opportunity Center (YOC) in mind but the format is applicable for use in any local office.

The source of the data was a Job Bank history tape for the Colorado Job Bank for 1971 and 1972. All job orders (ES Form 514) for this

period served as the source of information for the directories. Information from each job order was extracted and recorded on magnetic tape for further processing.

Another magnetic tape which contained the addresses of all of these employers was processed. This tape was manually edited to remove duplicates and erroneous entries, was sorted by the computer according to ZIP code, name and address, and was given to the YOC for use in the job solicitation drives. From this tape the Colorado Division of Employment produced for YOC its first automated mailing labels for use in job solicitation. Over 8,000 employers were contacted as a result of YOC's campaign. Many employers did, however, receive numerous copies of the campaign mail. The reason for this is discussed later.

The job information has been organized into three directories, each also available on magnetic tape:

1) Directory of Employers by Location
   (Sorted by ZIP,[2] DOT,[3] SIC[4] and employer's name and address);
2) Directory of Employers by Standard Industrial Classification
   (Sorted by SIC, DOT, ZIP and employer's name and address); and
3) Directory of Employers by Job Occupation (DOT) Code
   (Sorted by DOT, ZIP, SIC and employer's name and address).

Each directory is for the Metropolitan Denver Area and contains the same information, which is ordered differently.

Examples of typical uses of each Directory follows:

1) The Directory of Employers by Location could be used by an employment officer or counselor in finding those employers (who have used the Employment Service) who are located in a given geographical area (as indicated by ZIP code). Within a given geographical area, those employers who had placed job orders for given occupations (as indicated by DOT code) can be

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[2] ZIP refers to the ZIP code of the employer's place of business.

[3] DOT refers to the occupation code as specified in the Dictionary of Occupational Titles.

[4] SIC refers to the industry code as organized into Standard Industrial Classifications.

identified. This type of activity is useful when developing jobs for any given geographical area or when developing a job for a specific individual who is limited to a certain area (because of no public transportation, etc.). The latter is common when dealing with youth, such as at the Denver Youth Opportunity Center.

2) The Directory of Employers by Standard Industrial Classification could be used by an employment officer or counselor in identifying employers (who have used the Employment Service) classified by industry. Within each industry, those employers who had placed job orders for given occupations (as indicated by DOT code) can be identified. This type of activity is useful when developing jobs in a given industry or group of industries. It is also useful in developing a job for a specific person who wants to work in a given industry (because of union affiliation, equipment owned, etc.) with or without a specific occupation in mind.

3) The Directory of Employers by Job Occupation (DOT) Code could be used by an employment officer or counselor to identify those employers (who have placed job orders with the Employment Service) according to the occupation classification of the job opening. This type of activity is useful when developing jobs in a specific job area, either for a particular individual or for the Job Bank. This is the most common type of job development and job solicitation.

All three directories have the same shortcoming -- they are large and bulky. This is due to the fact that no consolidation of employer data was attempted beyond the experimentation stage because there was no easy way to determine if the same employer had submitted more than one order. Since there is no "employer identification number" on job orders, the only technique available is a comparison of company name and address. This was attempted when preparing the YOC mailing list but many hundreds of redundancies remained after computerized and manual comparisons due to inconsistencies in the way that employers have been listed, such as different spellings and abbreviations of company names and addresses. The number currently used in the Unemployment Insurance

Program if inputted on job orders would solve this problem.

In conclusion, very useful documents (directories) could be produced as aids to job development and to solicitation if some unique identification is given for each employer.

3.3.1 Benefits

1) Job developers of a local agency can examine job orders by employer, by ZIP code, by SIC code and by DOT occupation codes. This permits more selective job development, saving many hours of work for job developers.

2) Starting with an area of town, firms can selectively be examined and then approached.

3) Starting with a type of industry or type of occupation, the areal distribution of job orders can be examined.

4) A more selective and sophisticated approach to placement as well as job development may result if Employment Service personnel can focus on what employers want and can be aware of city-wide patterns of employment.

3.3.2 Costs

For the Denver area, assuming a unique identification is attached to each employer, the cost was under $5,000 for both programming and computer time to process job orders for a two-year period. Subsequent processing would cost less.

The cost for other areas depends on the number of firms, number of job orders and period covered by the directory.

3.4 Use of MICRO for Employment Service Research

An important application of a general retrieval language like MICRO is to enable an employment agency to improve its research capability. The Wisconsin Department of Industry, Labor and Human Relations was able to use MICRO to do an analysis of its unemployed. In the project they used data from the 1970 Census of Population, the Employment Service Automated Record System (ESARS) and characteristics of the insured

unemployed (ES 203)[5].

To illustrate the types of questions which might be asked of a general retrieval language, several examples are listed below. While it is possible to answer any particular question without a general retrieval language there is sufficient variability in the requests to make it cost effective to have this flexibility. Some examples are:

1) How many male unemployed workers are between the ages of 25-54 and are not disabled?

2) How does the universe of unemployed workers compare to the universe of persons who apply at the Employment Service? What are the characteristics of the two groups?

3) How do job placement rates change as persons receive one or more counseling sessions?

A major conclusion drawn by both the LMIS staff and the Employment Service staff that worked with MICRO is that even though the Employment Service staff can be taught to use the information retrieval system in a short period of time, so many new staff capabilities are introduced that extensive training is necessary to make its use most effective. The barriers are not a function of its simplicity or complexity but stem primarily from the need to provide Employment Service personnel with additional training in analyzing social science data. A data laboratory training program could do a great deal to improve Employment Service personnel and make them more responsive to new requirements suggested by Manpower Revenue Sharing. A synthetic data base and models can also simplify complex data bases.

3.5 Benchmarking

The LMIS Benchmarking Project investigated procedures for improving the quality and timeliness of statistical or administrative data bases, and assessed these costs. It designed two separate methods for accomplishing this, the first statistical and the second graphic.

The term "benchmark" refers to the process whereby statistical

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[5] A full report is available from the Wisconsin Department of Industry, Labor and Human Relations [17].

estimates of certain series are compared periodically with administrative series purporting to measure a comparable universe. For example, the current employment estimates from the BLS industry samples are compared annually with employment data by industry which is compiled quarterly by state agencies from reports of establishments covered under state unemployment insurance laws.

Administrative data is often collected as part of a legal requirement as with ES202 data which provides employment and wage information for every firm covered by the Unemployment Insurance System. Statistical programs such as the BLS 790 program also provide monthly hours, wages and employment data on a sample of firms. Benchmarking seeks to reconcile differences between the two series and adjust BLS 790 totals once a year to universe or ES202 counts.

The first product of these efforts is a set of statistical procedures for analyzing employment data, both by firm and by industry, for the purpose of searching out likely errors that should be corrected. The methods are potentially very powerful and could give state employment analysts useful information such as, "the employment for firm X is incorrect for April, 1973," or "the employment for industry Y is incorrect for May, 1973." The errors so detected could then be corrected by means already available to the state agencies, giving more accurate employment data more quickly than at present. (See Appendix E.)

Since the above procedures are new and mathematically complex, they will be difficult to implement by state agencies. Therefore, LMIS has further undertaken to automate an existing and well-understood procedure presently used by the state agencies for error detection. The result is a practical and easily-accepted graphic method, which will save hours of labor and be more accurate and systematic than present manual practices. The procedure is described in detail in Appendix F.

The method as presently used by the state agencies consists of graphing on the same axes the three different estimates of industrial employment that are kept. Then the three series can be easily compared by eye and major discrepancies between the series can be isolated. These discrepancies usually indicate the existence of errors in the data which require some investigation.

Volume II of the Operating Guide for the Current Employment Statistics Program, Bureau of Labor Statistics, (10.3 - 4) states that the maintenance of such charts,

> "...is strongly recommended ... As resources permit a chart series should be maintained for each estimating cell, each published industry group, the industry divisions, and total nonagricultural employment ... Regular review of the charts will often reveal developing weaknesses in the estimates before they reach serious proportions ..."

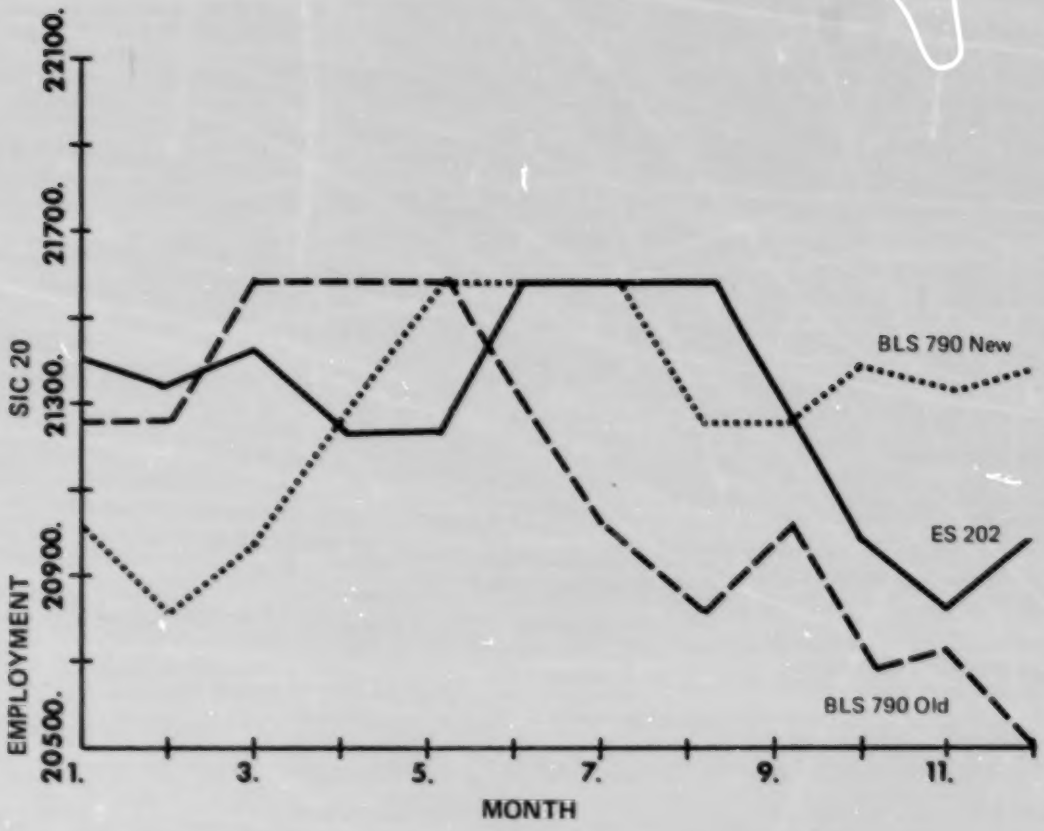
Unfortunately, substantial resources are required to produce these graphs. Several state agencies pay statistical clerks to work full-time drawing only graphs of employment. The graphs put out by the workers are generally of much lower quality than those done by a computer. The job is also a very disagreeable one, consisting of the most stultifying form of repetition.

Acting upon the suggestion from the Michigan Employment Security Commission (MESC) the LMIS Project has written a FORTRAN computer program which will direct a CALCOMP plotter to produce all of the graphs described above and will also produce a tabulation of differences among the plotted series. The advantages of using this new program instead of the manual method are three: quality, time and cost.

The quality of the automatic graphs can be seen in Figure 2, which shows one such graph from the CALCOMP plotter. The lines are drawn crisply in black ink with the three series differentiated by three different kinds of lines: the solid line is ES202 data, the long-dashed line is BLS 790 data of old benchmark, the short-dashed line is BLS 790 data of the new benchmark. The data series shown in the plot are hypothetical.

The format of these CALCOMP graphs should be distinguished from the format of "printer plots" produced by ordinary computer line printers, for example by "canned" programs which may be in use. Ordinary computer line printers cannot be used to draw a continuous line and so cannot create an actual graph, but only a series of disconnected characters. This is adequate for some purposes, but would not be convenient for mass-producing benchmark plots.

Figure 2 Computerized Plotting To Do Benchmarking



BENCHMARKING: TYPICAL CALCOMP PLOT

The most serious limitation of this program is that it must presently be run at Wayne State University or The University of Michigan under control of the Michigan Terminal System. However, this experiment demonstrates both the costs and benefits of the method and indicates the advantage of similar projects.

To generalize the plotting capability two approaches are possible: 1) renting time on computers and CALCOMP plotters of other private or public organizations, or 2) establishing such facilities in house.

3.5.1 Benefits

1) Computerized plotting can improve the quality of existing data series by calling attention to errors in the series.

2) The use of a CALCOMP Plotter to do plots for benchmarking instead of having a clerk do it is fast, accurate and inexpensive.

3) It automates a stultifying, disagreeable task, in which quality control is difficult because of the human element.

4) An alternative statistical procedure was suggested which could lead to even greater error detection than plotting. It may not be as easily understood by most state agencies, however.

3.5.2 Costs

1) The costs are around 25¢ per plot if done centrally.

2) Keypunching costs needed to prepare data for plotting should be assigned to the general desirability of having such data series machine-readable.

3) These costs assume that the data to be inputted are machine readable.

The benefit-cost ratio could be as high as 100:1 if benchmarking was done centrally. This assumes one man-year (of staff) for all United States data series, plus computer costs versus one man-year per state (50 man-years) per data base. The estimate excludes the benefits of greater accuracy and standardization.

The cost of having each state which currently does not have a plot facility buy a plotter and train staff to run and program, could exceed

what is currently spent for data quality. Under this latter assumption there may be no cost saving. The saving would be realized if the state already had a plotter.

The present project benefited greatly by using the UM and WSU facilities. The ability of these organizations to spread the overhead cost of plotting is evident in the small cost of the plots. It seems unlikely that an owned facility would be able to match these cost estimates.

The method shows great promise of upgrading the quality of state employment statistics. If it is successfully implemented for this purpose it will be simple and feasible to extend the method to other state data such as hours and earnings. Thus, what begins as a small improvement of an existing procedure, can eventually have substantial impact on the collection of state data and the systematic testing of that data.

Originally it was thought that a standardized plotting program could be used by a state Employment Service to produce computer incremental plots. However, the conclusion drawn from working with the Employment Service is that tailor-made plotting programs with manuals and training are required to increase the chances for their adoption. Telling a state that a standardized program to do plots is available is not enough. However, it is not necessary for each state's data processing staff to become proficient in plotting and mathematical programs. Alternatives are proposed in Chapter 5, Sections 5.3.2 and 5.5.

3.6 Minority Employment Information

A comparison of various sources of affirmative action data were analyzed and tables were generated for the three SMSA's (Detroit, Denver and Milwaukee). The sources compared included:

1) EEO-1 reports on employment by industry by occupation with race and sex breakouts; and
2) The 1970 Census of Population tabulation, employment, and occupation by industry by sex and race.

For Milwaukee some comparisons were also made to other sources to identify additional reasons for the discrepancy between sources such as Social Security employer records.

Since the EEO-1 reports refer to jobs (located in the area) while the 1970 Census refers to persons (living in the area) it is surprising that the two sources would yield similar estimates. However, they both gave fairly similar estimates of the percentage of females and the percentage of blacks for various occupation-industry subgroups.

The major difference between the two sources resulted from the tendency for women and blacks to report themselves in higher status occupation than their employers reported. Since this tendency was less prevalent for males, a higher proportion of women were reported in lower status occupations when comparing Equal Employment Opportunity Commission (EEOC) reports to census reports. In Milwaukee, for example, over 30% of the laborers were reported to be women according to EEOC reports compared with 13% according to census reports. In Detroit 36% of the laborers were black according to EEOC reports and 23% were black according to census reports.

If data were required on the percentage of females or blacks for broad occupational groups such as craftsmen, operatives, laborers, professionals, managers, technicians, sales and service, the EEOC reports could be utilized to better advantage. The data could even be disaggregated by industry within these occupational groups.

In addition to pointing out some insights into differences between EEOC and Census data as sources of Equal Employment Opportunity information, the study illustrated the value of a computer language like MICRO for analysis of survey data. On a number of occasions it was desirable to retabulate data in an unforeseen form as hypotheses were suggested. This was readily possible using MICRO.

The study also suggests tabulations which could be run for SMSA's in the United States using 1970 Census data and EEOC data. Further disaggregation for races other than Negro and disaggregation for the nine occupation groups by summary industry groups would also be desirable in addition to the basic tabulations shown in Appendix M. Such tabulations are available in the 1970 sixth count Census tapes. EEOC has been publishing tabulations on a fairly regular annual schedule.

Continued publication could be useful to manpower planners. The manpower planners also may find our study useful in understanding differences between the two information sources.

A final by-product of the project was a feasibility study on storing confidential government data on an on-line computer information system. The availability of data on individual firms which could be retabulated in any way required by the analysis was an invaluable tool in making comparisons between EEOC and other data sources, as Appendix M points out. At the same time, several steps were taken to ensure the confidentiality of the individual records. Original tapes were stored in locked vaults. Data stored on the computer was accessible only to the users who were doing the analysis and the programmer who inputted the data. These persons had to provide a secret password to gain access to this information. Once they gained access they had to type another password to unscramble the data. If they wanted to save a subset of the data they had to assign the subset a third password which they had to remember to unscramble the data. Typing in an incorrect password would not give an error message. It would only give unrecognizable strings of random numbers in response to queries. Scrambling increases the cost of using such files by 300%. The cost depends on the number of times the file is accessed relative to the amount of analysis done once the file is used. Because the cost of accessing the file is substantially greater than the cost of accessing other files, the use of scrambling must be seriously weighed before deciding to ensure confidentiality in that way. The issue is balancing the risk of disclosure against costs. One could spend an infinite amount of money reducing the probability of disclosure to close to zero without ever completely eliminating it.

3.6.1 Benefits

1) The analysis provides a comparison of census and EEO-1 information which suggests the usefulness of EEO-1 data for minority employment analysis.

2) Some general problems in comparisons between establishment and household data were highlighted. Employees upgraded the status of their occupation relative to what employers reported.

3) The project was also used to test the feasibility of storing confidential data on-line on a time sharing computer. The data security was maintained through passwords and data scrambling. If non-authorized users were able to access confidential files accidently, scrambling was shown to be useful.

3.6.2 Costs

1) EEOC currently edits and tabulates EEO-1 data.

2) The cost of storing, scrambling, unscrambling and using confidential data is about three times the cost of storing unscrambled data. The actual cost depends on the data retrieved per access and the size of the data file.

3.7 Conclusion

The capability exists to provide labor market information in a better, more timely and more easily utilized form. Systems like MICRO can supply non-technical personnel with information, which will help them provide high quality counseling and planning services to the public. Such systems can be designed for easy use by non-computer specialists. Other systems like computerized plotting and statistical analysis can lead to improvements in the quality of the data.

Millions of dollars are spent every week on the generation of labor market data by the Department of Labor, Department of Commerce and State Employment Agencies. This data is used to generate reports which encompass only a small fraction of the possible reports which could be issued to meet the needs of manpower planners, Employment Service counselors, job seekers, employers and manpower agency administrators. The MICRO computer language was developed as a prototype system to test the feasibility of increasing the value of currently generated labor market information by improving the technology by which data is converted into information.

In the process of testing the prototype, some information gaps were uncovered which could not be met with existing labor market data. These gaps are discussed later. However, many needs were uncovered which were not being met because the computer technology being utilized was not adequate.

Employment Services can not respond to the information needs for planning for one or more of the following reasons:

1) The cost of tabulating labor market information for special uses is high,
2) Since individual programs have to be written to meet special requests, time delays are often too long to meet needs,
3) Data processing staffs of most state employment agencies are not trained to respond to special-purpose user requests, and
4) Data prepared for one purpose is often not sufficiently documented for other purposes.

The proposed alternative is for government agencies to design data bases which could be utilized for a number of information needs. The cost of designing data bases rather than tabulating data for single reports may be 20-25% higher than the cost of the original reports, but the cost of subsequent reports may be 80-90% lower than the costs which would now have to be incurred. Data bases could be accessed by non-programmers using a computer language such as the MICRO language prototype. Not all labor market information generated by state and federal government agencies must be stored in the data base. Not all state agencies would have to have their own information retrieval language. Using a time-sharing computer, regional centers could service smaller states.

The first step is a policy statement from the Manpower Administration in Washington recommending this alternative. The second step is a study of alternative commercial and noncommercial systems for meeting the needs of users of labor market information.

CHAPTER FOUR

LOCAL LABOR MARKET MODELS

4.0 Introduction

This chapter describes several local labor market manpower models developed by the LMIS Project. These models include the LMIS model of labor supply and demand, a model of unemployment insurance, a model of the Universe of Need (that is, a model determining the number of people in a given area who could use the services of the Manpower Administration), and a model that relates the number of local welfare claimants to conditions in the local labor market and parameters of welfare policy.

These models are primarily designed to help answer questions of interest to state and local planners about some aspects of local labor markets. For example, the models can be used to construct synthetic data bases for planning manpower programs. Synthetic data bases are needed when current data are not available. For example, a model can predict the number of persons who want to work even though data are not collected on this question. Forecasts can also be generated in a consistent framework. Thus models can generate estimates of otherwise unavailable current information, at a considerably reduced cost.

4.1 The LMIS Model

The LMIS model represents the result of an experiment to build an econometric model primarily designed to "model" the response of employment and unemployment in local labor markets to cyclical economic forces. The geographical unit of analysis is the Standard Metropolitan Statistical Area (SMSA). Thus, although the model belongs to a growing class of attempts to use econometric models to improve our understanding of both the cyclical and secular development of various aspects of "Regional Economies,"[1] it is the first attempt we are aware of to model, in some detail, the cyclical forces determining labor demand and supply within an SMSA. Most previous studies of regional labor markets have concentrated

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[1] For an interesting summary of some of these effects, see Meyer [13] and Milliman [14].

either on determining the labor requirements for a particular configuration of output (through input-output studies), or on the relationship between "export" induced employment and the total employment of a region (community economic base studies). The studies of Hirsch [7] and Thompson [18] provide early examples of the "requirements" approach and the "export-base" approach, respectively. Both of these approaches are concerned with the estimation of the effects on local employment of shifts in export demand (aggregate demand generated outside the region).

In a recent study, Baschler [1] provides an interesting discussion of the possible equivalences of these two procedures, while Humphrey [10] has contributed a useful article setting forth a suggested methodological framework for future investigations of this type. A study by Dockson and Shreiner [3] is a good example of a more recent empirical study on local employment patterns, but this work confronts a somewhat different topic--the effect of private investment on the pattern of state employment. Another class of studies on local employment has been generated out of the broad literature on location theory. These studies deal with local employment as part of the dynamic movement of populations between urban and rural regions and/or between various growth centers. The study by Lewis and Prescott [11] is a good example of this approach. There are only a few studies on the determination of local labor force participation rates (e.g., Parker and Shaw [15]) and all of these are developed on the basis of cross-section data and, therefore, contain no dynamic elements.

None of the above studies deal adequately with the mechanism by which supply and demand adjust over time to changes in various stimuli. Perhaps the study that is closest in spirit to the current investigation is the work of Glickman [4] on an econometric forecasting model of the Philadelphia region. Glickman's model contains an employment-wage-labor force sector as one component of the model which also forecasts local output (by three sectors) and income. The LMIS model has a considerably more complex articulation of the labor market, but contains no mechanism for the determination of local output. The particular objective of the present model is to produce a mechanism capable of assisting in policy analysis, forecasting and other aspects of decision making relating to local (SMSA) labor markets.

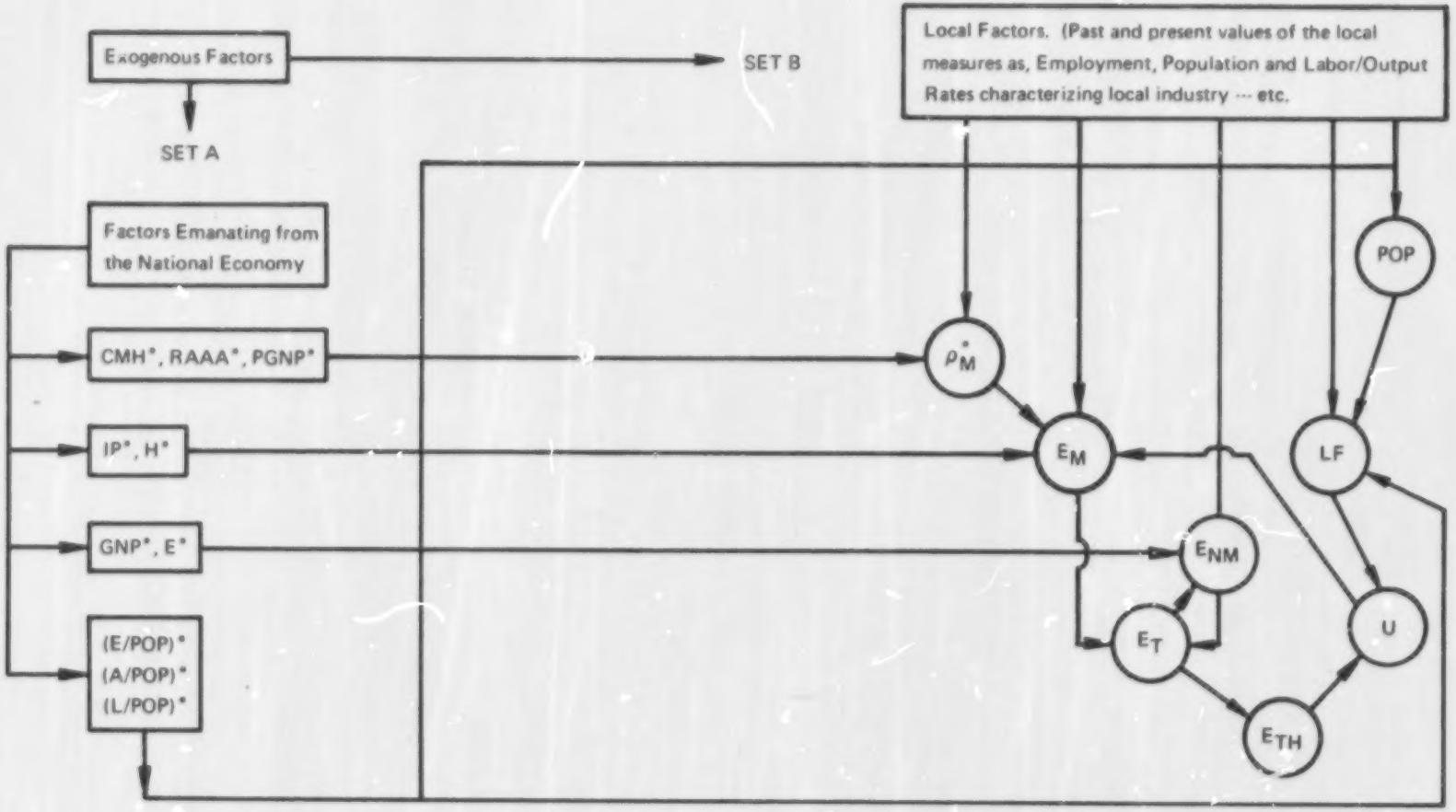
The model also differs from the Employment Service procedures for construction of labor force estimates because the LMIS model predicts the number of persons in the labor force, while the Manpower Administration procedures predict the work force by augmenting the number of jobs in the area by an estimate of unemployment [2, 5]. Since other Employment Service procedures measure "persons" who need manpower programs, a technique for generating labor force as opposed to work force estimates has something to offer.

The Manpower Administration [20] procedure to estimate the number of persons who might need training or placement services is based on a similar labor force/non-labor force concept.

The LMIS model might suggest a superior alternative for estimating local employment and unemployment. However, it is new and experimental. Therefore, it will require more comment, experimentation and testing before it can be considered for use in this way.

The model is primarily concerned with isolating, from quarterly time series data generated over the period 1956 through 1972, equations which predict SMSA employment by industry, labor force participation rates, and population by age/sex groups as well as the aggregate levels of both local unemployment and the local labor force. The current investigation studies the labor markets of Detroit, Milwaukee and Denver, each of which is represented by a separate set of relationships attempting to describe certain key aspects of the operation of labor markets in these areas. Thus, the LMIS model consists of three separate modules (one for each of the above SMSA's) which operate independently of each other. All three modules, however, are built around the same conceptual framework and attempt to pattern the same aspects of the local labor market in each case. This general framework could, in principle, also be applied to other SMSA's. The flow diagram presented in Figure 3 summarizes the basic outlines of the model used. The diagram represents a substantial simplification of the actual model and should, therefore, be interpreted with some care. It does, however, reflect some of the principal forces at work.

Figure 3 Principal Forces Determining Local Employment And Unemployment In The LMIS Model.[a]



[a]Items with asterisks are national variables.

FIGURE 3 Variable List

a) National Variables (designated by an asterisk on FIGURE 3)

A	Employment in Armed Forces
CMH	Compensation per Manhour - Private Nonfarm Sector (Current Dollars)
E	Total Employment (Establishment)
GNP	Gross National Product (Constant Dollars)
H	Average Hours Worked
IP	Industrial Production (Manufacturing)
L	National Labor Force
PGNP	GNP Price Deflator
RAAA	Triple A Corporate Bond Rate

b) Local (SMSA) Variables

E_M	Employment in Manufacturing
E_{NM}	Employment in Non-Manufacturing
E_T	Total Establishment Employment
E_{TH}	Total Employment (Household Basis)
LF	Labor Force
POP	Population
U	Unemployment
ρ_M	Desired Labor/Output Ratio for Local Manufacturing Industries

The following features of the model should be noted:

1) Local employment is heavily influenced by both the level and composition of national aggregate demand. Indeed, these are the most important forces determining the variation in local employment levels. However, as one would also expect, non-manufacturing employment is relatively less dependent on changes at the national level than employment in the manufacturing sector.

2) The model is primarily focused on short-run, cyclical changes in local employment; It does not deal directly with the issues of long-term (secular) shifts in employment patterns except by trend extrapolation.

3) The design of the model calls for a uni-directional flow of causality from the national economy to the local labor market. There is no provision for any feedback into national economic activity caused by the evolution of economic events in the local labor market. Although this feedback undoubtedly exists, it is assumed to be of minor importance.

4) Wage and interest rates are assumed to be governed by forces at the national level.

5) The demand sector of the model generates total establishment employment (number of jobs). Total employment on a household basis is then derived in order to generate estimates of the level of unemployment.

6) Although net migration and commuting are important channels of adjustment in local labor markets, the current model does not adequately provide a mechanism for the determination of these flows. The principal difficulty in isolating these mechanisms is the lack of appropriate time-series data. The model does allow, however, for independent projections of these flows to interact with other elements determining the rate of participation and unemployment. Thus, a researcher or analyst could use the current model to investigate the effects of shifts in these flows. In the current versions of the model, only population growth rates are reflected by changes in birth cohorts and migration patterns.

7) The lack of time series data on the local labor force by age/sex groups necessitated the extensive use of parameters estimated from national data in that part of the model determining labor force participation rates by age/sex groups. These parameters were then adjusted to reflect local

conditions through information available on the composition of the local labor force at census dates. Thus, in each of the model's modules the parameters reflect the influence of local conditions, although somewhat imperfectly. The resulting sets of parameters were then used together with variables reflecting local labor market conditions to generate local labor force participation rates over time.

8) The model underlying the demand equations for employment in manufacturing is quite distinct from that used in the non-manufacturing sector. In the manufacturing sector the desired mix of labor and capital (toward which the firm is moving) is determined by relative prices, and short-run employment decisions are centered around expected demand for output and the existence of a surplus (deficit) of workers in a firm. Thus, "labor hoarding" is allowed a significant role. In the non-manufacturing sector a somewhat simpler model is employed.

9) In principle, the model can be disaggregated to more industry groups. In preliminary versions of the model, more industry groups were used. The present model, however, was limited to a smaller number of groups for expository reasons and to make presentation of the model simpler.

10) The model could also be used to predict demand for employment by occupation by applying the BLS occupation-industry matrix to the detailed industry matrix predicted by the LMIS model if more industry groups are included in future model simulations.

Each of the model's modules contains a mechanism to determine the following labor market variables:

Employment

1) Manufacturing employment (establishment basis)
   a) Durables
   b) Non-durables
2) Non-manufacturing employment (establishment basis)
   a) Construction
   b) Financial institutions, real estate, services and mining
   c) Transportation and public utilities
   d) Wholesale and retail trade
   e) Government

3) Total employment (establishment basis)

4) Total employment (household basis)

Labor Force and Population

5) Labor force by 10 age/sex groups

6) Population by 10 age/sex groups

7) Total labor force and population

Unemployment

8) Total Unemployment

Miscellaneous

9) Desired capital/output ratios in durable and non-durable manufacturing.

Appendix A contains more details on the model.

Appendix A describes in detail the derivation of each of the above relationships. It does not contain empirical results. A future study will include empirical findings and the results of a number of simulation studies designed to reveal the basic properties of each of the three models and to illustrate some of the ways these models may be used as aids to policy decision making.

Current research is exploring local employment patterns and relationships using spectral methods as the principal statistical tools. Univariate spectral analysis isolates the various time series components (largely the seasonal, cyclical, and secular components) making up an economics time series such as an employment series, and thus presents some useful characterization of the series. The spectral representations normally have simpler and more desirable statistical properties than their time domain counterparts. Overall, univariate frequency domain analysis offers a more complete, accurate, and revealing description of a given time series than does univariate time domain analysis.

Although spectral analysis has so far found few applications in labor economics, we think our preliminary analysis of the national and SMSA employment series on durable and non-durable manufacturing has yielded some useful insights on cyclical behavior, especially in the shorter

cycle regions.[2]

Also, initial investigations utilizing multi-variate cross-spectral analyses have focused on the issue of short-run and longer-run labor input adjustment behavior through hours changes and employment changes in response to cyclical output behavior over our sample. Not only are the results of such an investigation interesting in themselves, but they provide additional insight into the structural specification of related regression models, which in turn aid econometric prediction and forecasting.

4.1.1 Benefits

1) The procedure gives good forecasts of industry demand by SIC (Standard Industrial Classification) for local areas.

2) The model will be of considerable value for local manpower planning under manpower revenue sharing, because it substitutes analysis for immense quantities of data.

3) Unlike the conventional Employment Service 72-Step Procedure for forecasting area unemployment, the entire procedure generates labor force instead of work force estimates.

4) Computerization of forecasting procedures through SOLAMI, with easy choice of options and easy parameter adjustment, is a large efficiency gain over older procedures. Hand models are so cumbersome and slow that one cannot consider many options without large time expenditures.

4.1.2 Costs

1) Cost per run is $1 to $5. This is such a minor cost that analysts will be able to quickly extend their analytic options and consider many alternatives.

2) Cost to transfer the program to other computers is a one-time cost of writing more general FORTRAN code, estimated under $10,000.

3) Cost to re-estimate parameters for each new SMSA, and to deal with special data problems, is a marginal cost of $5,000 per SMSA.

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[2] Hammermesh [6] has used spectral analysis to study the relationship of short cycles in national output and employment figures.

4.2 SOLAMI Simulation Program

The LMIS model is programmed into an interactive computerized simulation model called Simulation Of Labor Market Information (SOLAMI). SOLAMI enables the user to alter the various parameters of the econometric model and thus to simulate the LMIS model outlined in Section 4.1. SOLAMI costs only a few dollars to run (usually between one and five) and is a powerful tool which planners and policy makers can use to simulate and study the future of the labor markets of the three SMSA's under varying conditions. The program is currently working at Michigan. (See Appendix C for a manual on how to use the program.)

Though the econometric model being developed is only for Detroit, Denver and Milwaukee SMSA's, the procedures used and the theory developed are quite general and similar models for other areas can be created without any great difficulty. The SOLAMI program, written in FORTRAN, is quite general and can be used for other SMSA's as well. However, the program would have to be rewritten to remove some of its dependency on the University of Michigan computer. This would require less than six man-months of programming.

An approach combining the LMIS model with the SOLAMI simulation program offers other advantages:

1) It is possible to carry out sensitivity analyses on the model in a few minutes to determine the impact of possible errors in assumptions on estimates.
2) It is possible to update the data and reforecast in a few minutes.
3) The assumptions are clearly laid out and can be easily duplicated or challenged by others.
4) Forecasts of the future, synthetic data bases for the present and validation of the model by predicting past known values can all be accomplished in the same consistent framework. The data used in the model is described in Appendix B.

4.3 An Unemployment Insurance Model

The central and by far the most important support for unemployed workers in America is the unemployment insurance (UI) system. The determinants of the amount of this support are (1) the structure of the UI system and (2) the ebb and flow of employment.

The LMIS UI model is designed to apply LMIS research on employment toward the practical goal of forecasting UI benefit loads. This is presently done for federal unemployment compensation programs by the UI Service, but has only recently been attempted for states or metropolitan areas. Specifically, three useful quantities are projected by the LMIS UI model for the Detroit Standard Metropolitan Statistical Area (SMSA):

1) The cost of UI payments in dollars. These payments are drawn out of state funds contributed by firms for UI purposes. The proper administration of these state funds requires projections of the level of UI costs in future months. For example, knowledge of future UI costs facilitates timely and orderly requisition of funds from the state's unemployment compensation trust fund.

2) The number of insured unemployed workers. This figure is equal to the number of UI claims (excluding initial claims) being made and will be an indicator of the activity to be expected in the UI branch offices. It would also be useful to compare the insured unemployment with total unemployment to get a view of the adequacy of the UI system.

3) The number of UI benefit exhaustions. This measures the number of people who will receive their final UI payment and become ineligible for further compensation. These people will be forced to provide income for themselves in other ways. Hence, they may require support from the welfare system or other expenditures by the state.

The cost of UI benefits is closely related to the number of insured unemployed workers. This cost in dollars can be found by multiplying the number of UI recipients by the average payment. The number of recipients is slightly less than the number of insured unemployed (allowance must be made for waiting weeks and disqualifications) and the average payment is primarily a function of recent wages. These simple relationships define the first econometric equation, which gives benefit costs as a function of insured unemployment.

The size of insured unemployment has long been considered a difficult quantity to forecast and the forecasting problems that exist are more severe at the state or SMSA level than they are at the national level. One difficulty is that the SMSA unemployment rate is derived from data

collected on unemployment insurance claimants, while federal unemployment rates are computed from the Current Population Survey.[3] The Current Population Survey (CPS) is available for only a few metropolitan areas and is usually only published on an annual average basis. Thus, since the SMSA unemployment figure has been derived from the insured unemployment figure, it should not be used to re-calculate the insured unemployment figure. This would amount to calculating A from B and B from A without obtaining any net improvement in information. The state unemployment figures are useful generally, but not for direct use in a UI model.

Even if an independent unemployment estimate were available (such as from the CPS) there would be problems with using it to predict insured unemployment. The insured unemployed are primarily "job losers," whereas total unemployment includes "job leavers" and "new entrants" to the labor force.[4] The relative size of the three aggregates changes over the course of the business cycle, leading to an often observed phenomenon where the insured unemployment rate rises relative to the unemployment rate in the beginning of an economic downturn and reverses itself during the upswing.[5] Furthermore, the insured unemployed may exhaust their benefits during a long spell of unemployment. When they do, they diminish the number of insured unemployed, but not the number of total unemployed (insured plus uninsured).

It might be possible to build a model of insured unemployment (assuming there were no definitional problem) which begins with total unemployment and reduce this number by the fraction of "job leavers," new entrants and exhaustions. It was decided not to pursue this direction,

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[3]The so-called "72-Step Procedure". Bureau of Employment Security. [2]

[4]CPS data by area on reason for unemployment will soon be available and can help in the analysis.

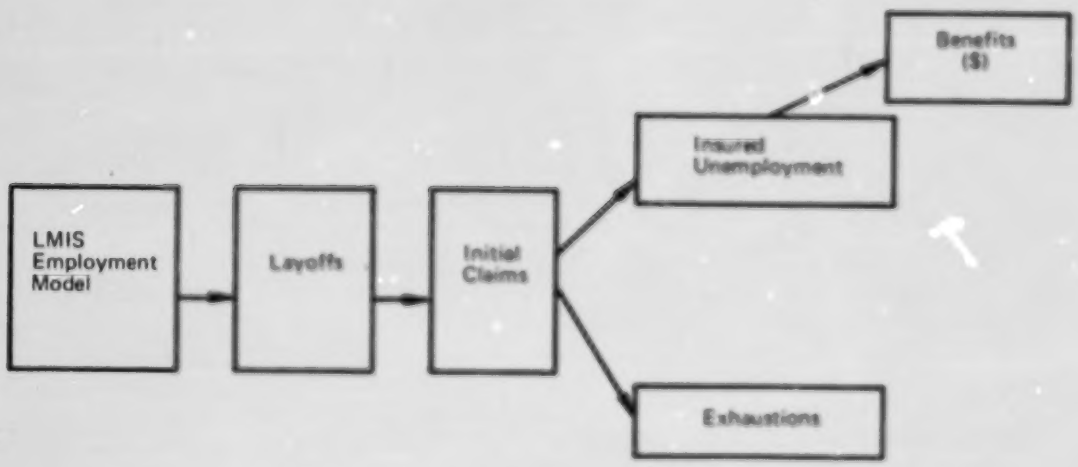
[5]See for example Green [5].

not only because of the definitional problem, but also because the amount of spurious variation introduced by the uninsured unemployment variables would be large.

The present LMIS model avoids the uninsured unemployment problem by dealing only with workers who have been laid off from their jobs. It is based upon the layoff rates from the Job Openings and Labor Turnover Samples (JOLTS). Two equations are used: (1) The first equation predicts the number of layoffs. The difference between the two results from layoffs in non-covered industries and laid-off workers who do not file for UI. (2) The second equation predicts the number of insured unemployed from the number of initial claims. This is done by using a system of survival rates (analogous to survival rates in population models) to predict the number of people receiving UI from the number who made initial claims in previous months. The two equations work together to predict insured unemployment from layoffs.

A final equation predicts benefit exhaustions from initial claims using a similar survival rate method to predict the number of people who are still unemployed at the end of their maximum benefit duration. Figure 4 summarizes the linkages in the entire model. Each box represents an important variable and each arrow represents an econometric equation to link two variables. The variables are standard UI and labor turnover variables compatible with existing Employment Service data.

Figure 4 Flow Chart for UI Model



In practice, the model predicts quite accurately. For example, the most important, but difficult, equation for insured unemployment explains 98% of the variation in insured unemployment. Each of the other equations attains a similar level of accuracy.

In addition to providing forecasts of the three useful quantaties mentioned above, this model will provide answers to critical questions about the UI system itself, particularly regarding the costs and benefits of proposed alterations to the UI system. For example, if the maximum duration of UI benefits is increased from 26 to 39 weeks, the model can predict the increase in insured unemployment, the increase in the cost of UI payments and the decrease in the number of benefit exhaustions. Forecasts can be obtained for any reasonable increase or decrease in the maximum duration of benefits. The model will provide estimates of the number of payments and exhaustions that will result.

Other types of questions which can be answered by this model are the effect of increases in the industrial coverage of a state UI system, alterations in the rules for making monetary determinations for new UI claimants or changes in the average amount of payments upon insured unemployment, payments and exhaustions. The model will simulate the proposed UI system and generate forecasts of these variables for the new system. The forecasts will be useful to lawmakers in estimating the costs of their proposals and in judging whether the UI system they propose will achieve the income security they seek.

The model is currently in the form of final equations which have been tested successfully over the sample period for Detroit from 1966 through 1971. The next step is to test the model for its predictive power beyond the sample period and run simulations to test alternative policies. This step is progressing under a doctoral dissertation grant from the Manpower Administration (No. 91-26-74-03).

While the model has been developed for Detroit, it is equally applicable to the entire state of Michigan. This would involve reestimating the equations using state data. The model should be thought of as a

prototype for similar models which could be developed for other states or for other SMSA's. Since UI systems differ among the states, models for other states will differ from the one for Michigan, but will retain the same basic structures. This is, of course, the great advantage of state or SMSA-level UI models: their scope is no larger than the UI systems themselves. (See Appendix D for further details).

The UI model is a tool which could be used throughout the Employment Service to make forecasts and analyze UI proposals at either the local or state levels.

4.3.1 Benefits

1) The model may be developed to the point where one can analytically predict the effect on claims and payments of changes in UI laws. This would be a major aid to state decision makers. For example, policy makers could determine the effect of eliminating the waiting period on projected UI payments.

2) The model can be used to aid policy makers in forecasting the effect of changes in economic environment on UI claims, payments and exhaustions.

3) The model is better able to predict the level of the UI fund than previous models. In principle, this could be translated into dollar gains by resulting in more accurate levels of required reserves, and better management of the UI fund money.

4.3.2 Costs

The model will be relatively inexpensive to calibrate for different states ($2,000 in computer costs). On the other hand, training a data processing staff unfamiliar with mathematical modeling to develop similar systems could cost ten times that amount. The services of a full-time analyst would cost $20,000 per state. However, one analyst in a regional system could handle the model for several states.

4.4 Welfare Model

The dramatic growth of the welfare rolls in the past ten years has not only put enormous strains on public finances, but has also been an important and poorly understood factor in the operations of the urban labor market. The paucity of good predictive models of welfare caseloads through time has hampered urban policy makers in their planning efforts. In the absence of any better model, welfare departments have had to naively assume that welfare rolls would continue to exhibit the explosive growth observed in the recent past. Our study draws upon the previous work of Daniel Saks [16]. The model is inexpensive to use and is estimated from local data so it is a planning tool for many urban labor markets.

In the model it is assumed that expectations about the number of welfare cases in any welfare program at any particular time depends on the joint behavior of both welfare recipients (actual and potential) and welfare administrators, since both parties have expectations about the labor market and the welfare system. Potential and actual welfare recipients have to compare the relative values of their opportunities in the welfare system and elsewhere; if there are few or no reasonable labor-market alternatives, they will probably choose welfare. Similarly, welfare departments, to the extent that they have any control over their caseload, have to consider the state of the labor market in regulating the welfare system. Expectations are always adapting to changing readings of the state of the world. When expectations adjust in some specified, regular way to actual observations, this kind of model can often be estimated. The model was estimated from quarterly data for the Detroit SMSA over the past ten years.

The independent variables in the model can be divided into several sets. First, four labor market variables were used: (1) the difference between the total and insured unemployment rate; (2) the rate of exhaustions of the insured unemployed; (3) an unskilled male real wage index and (4) an unskilled female real wage index. These labor market

variables were chosen with the idea that the welfare system is most relevant to those who are unemployed and not covered by unemployment insurance or who have exhausted their benefits under that program. The difference between total and insured unemployment was highly significant for the old age assistance and general assistance categories and it consistently had the correct relationship for all categories (i.e., the greater the difference, the higher the welfare caseload). The rate of exhaustions had neither significant nor consistent signs across categories. The wage variables were inconsistent and, for some categories (the single-head AFDC and the general assistance cases), they even displayed a significantly wrong sign. This kind of result may be due to the aggregate nature of the wage variable, (a hypothesis supported by Saks [16]). Welfare opportunities were represented by the average welfare payment in the particular category adjusted for changes in the Detroit cost of living. Results for this variable were also mixed, with the model working well in the old age assistance category, less well in the aid to the disabled categories, and not at all in any of the others. The only category for which a variable could be introduced to represent opportunities other than the labor market or the welfare system was the old age assistance program. Average Social Security payments to retired persons (adjusted for changes in the Detroit cost of living) was a significant determinant of caseload in the old age assistance category.

The dynamic characteristics of the estimated equations are perhaps the most interesting aspect of this study. Techniques were employed to determine whether welfare caseloads are growing explosively, as many have thought, or whether they are converging to some fixed level through time (stable). It turns out that the equations for all of the categories are stable. For example, the equation for the AFDC single-head category is converging on the level of 25 cases per 1,000 of Detroit population. If the world does not change, this means that based on estimates from data ending in 1970, AFDC caseloads have been converging on a level close to that observed in 1973. This agrees with the most recent experience of the welfare system, where there is some evidence that the growth in the rolls is ending.

In conclusion, it seems that the model developed in this study could be an extremely useful tool for analysis of the dynamic properties of welfare caseloads, and it has already proven useful in demonstrating the stability of the welfare system. Further, the model is inexpensive and data is available to calibrate it in many urban areas. Although one could think of a variety of ways of improving the model by, for example, estimating more complex systems of equations, the simple model does remarkably well. A future study will describe the model in greater detail.

4.5 The Universe of Need Model

Currently, the Department of Labor estimates the number of persons who need manpower services, both at the state and national levels. The Region VIII office of the Manpower Administration asked the LMIS Project to examine possible underestimates of the universe of need in their region. In all six states of Region VIII, the current methodology led to estimates less than or nearly equal to agency intake experience, while professional knowledge suggested that the universe estimates should be considerably larger. Estimates less than intake were clearly unacceptable. Rather than treat it only as an *ad hoc* problem in labor market information, we also regarded this as an opportunity to demonstrate a use of MICRO for labor market analysts. In our project we tried to use MICRO data to improve the estimates using the same conceptual framework as followed by the Manpower Administration, although we have serious questions about the conceptual framework.

We found that procedures of the Research and Analysis Letter (RAL 801 [20]) led to very large and consistent underestimates of the poverty populations of five of the six states. This was the principle error and it caused the totals for the states to be too low. See Table 1. The major source of difficulty was that RAL 801 was designed to permit agencies to use published Census data. This necessitated numerous (and often inaccurate) interpolations from figures available in Census publications by using ratios from national averages. Individual states often

TABLE 1

Comparison of Two Universe of Need Estimates with ESARS Intake, Region VIII, FY 1974

	COLORADO[5]				NORTH DAKOTA			
	M.A.[1] Suggested Procedure	Revisions[2] or Other Values	Agency[3] Intake	New[4] Estimates	M.A.[1] Suggested Procedure	Revisions[2] or Other Values	Agency[3] Intake	New[4] Estimates
Total U. of Need	258,700	FY '73 Value 249,400	244,500	X%=14.5% 289,400[6]	71,700[9]	-	75,800[9]	X%=21% 96,000[6]
Poor	68,900	FY '73 Value 97,500	65,600	(87,000) 99,600	15,300	-	11,000	(33,200) 40,200
Disadv. Poor	59,500	FY '73 Value 76,200	58,400	(68,100) 78,000	13,700	-	9,800	(26,000) 31,500
	MONTANA[7]				SOUTH DAKOTA			
Total U. of Need	119,300	-	103,600	X%=11% 112,800[6]	68,900	114,973[10]	77,700[9]	X%=12% 99,200[6]
Poor	38,600	-	13,500	(28,900) 32,100	16,700	61,200[10]	15,600	(42,000) 47,000
Disadv. Poor	29,000	-	11,200	(21,900) 24,300	15,100	47,000[6]	14,000	(32,700) 36,600
	UTAH[8]				WYOMING			
Total U. of Need	221,600	221,600	128,300	X%=17% 235,400[6]	-[11]	42,400[11]	-	X%=15% 42,200[6]
Poor	31,100	33,400	22,000	(33,400) 44,900	-	13,200	-	(11,300) 13,000
Disadv. Poor	22,700	25,000	19,300	(24,300) 28,400	-	8,600	-	(8,600) 9,900

TABLE 1 (Cont.)

NOTES AND COMMENTS

Headers

1 The "M.A. Suggested Procedure" refers to estimates derived by states following the RAL 801 procedure, using 1970 Census data for projecting FY 1974. The figures are inflated from 1970 values by an amount that reflects the state agency's estimates of total population or labor force growth since 1970. No attempt is made to deal with the fact that the "poor" population may grow faster or slower than the total, due to a selective impact on the local labor market of changing economic circumstances.

2 "Revisions or Other Values" refers in Colorado's case to "other values", i.e., the interesting contrast between the RAL 683 values derived for FY '73 from 1960 Census data and the FY '74 values from RAL 801. The values for FY '73 are closer to "proper" levels than are FY '74, even though the former's base data was 12 years older. For the states of Utah, South Dakota and Wyoming, the "Revisions" are upward estimates in universe of need to better fit the states' Employment Services' need to have "better" values for their Plan of Service. See notes 8, 10, 11.

3 "Agency Intake" refers to the number of different persons reported to be serviced by the state agency in Calendar Year 1973 in the ESARS Applicant files. Note that there is no a priori reason why total ESARS intake should correspond to the conceptual total in RAL 801's value; because non-poor persons who show up at the door of the state E.S. do not necessarily represent that portion of the non-poor approximated by RAL 801. However, it is ludicrous for any estimate of a "universe" that justifies funds, to come out less than the agency's actual intake. Hence, the non-poor component of "universe" should be brought into line with agency service practices, or else, agency service practices be required to fit the implicit policy of such measures.

4 "New Estimates" are derived from use of MICRO on the 1% Public Use Sample of the 1970 Census, and inflated for 10% undercount of the poor and inflated by the estimated growth in a state's total labor force. The term "X%= 14.5%" and so on in each state's table is the expansion percent used for states growth. Under this header the figures in parentheses after "poor" and "disadvantaged poor" are the MICRO estimates from the 1970 Census, plus 10% for undercount. The figures immediately below those, not in parentheses, have the growth percent and are what should correspond to RAL values for "poor" and "disadvantaged poor".

Notes in the Tables

5 Note that FY '73 poverty estimates are closer to the new estimates than

TABLE 1 (Cont.)

are FY ' 74 estimates, even though FY '73 were extrapolated from 1960 Census. The FY '73 values and the new values both bear a "reasonable" relationship to agency intake of "poor" and "disadvantaged poor" while the RAL 801 values do not.

6 The values of "Total Universe of Need" under "New Estimates" are for all 6 states: a combination of RAL 801 "non-poor" plus new estimates of "poor." Its acceptance of RAL 801 "non-poor" is strictly for purposes of comparison of totals across the board.

7 For unknown reasons, Montana's estimates are alone in being higher than the new estimates of universe of need. The RAL and new estimates are, however, within one standard error of each other. It is possible that Montana's figures were also revised upward, but we have no indication of it.

8 The Utah FY '74 revised universe of need values for the "poor" are nearly identical to 1970 MICRO estimates. However the Utah RAL values and upward revisions include growth since 1970, so that their values fall below MICRO values plus growth.

9 Note that North Dakota's and South Dakota's totals for RAL 801 universe of need are less than total intake as measured by ESARS.

10 These upward revisions for South Dakota FY '74, were requested by Mr. Goodjohn of the Regional Office, and were executed by Paul Ray of the LMIS Project staff. They are incorrect due to a conceptual error. The revised estimates are too high, because the "poor" and "disadvantaged poor" include <u>all</u> poor persons aged 16-64, not excluding from "not in the labor force", the disabled, students or women with children under 6. We apologize for any inconvenience this error may have casued. The new "poor" estimates are "only" three times larger than RAL values instead of four times larger.

11 The original RAL 801 estimates for Wyoming appear to have been destroyed, but are known to have been considerably lower than the revision. The Wyoming revised estimates fit ours exactly. The ESARS Applicants data on intake was unavailable at the time of this writing.

depart markedly from national averages, and Region VIII's states seem especially prone to do so. Our approach was to use the 1% Public Use Sample of the 1970 census (available as computer tapes with coded interviews representing 1% of each state's or SMSA's population). We directly tabulated the categories of universe of need from the sample of the Census by using MICRO. This was a check on RAL procedures, because all that was done was to aggregate subsets of a sample of the original census records to directly compose the universe of need population, rather than to attempt to find a means for adjusting already aggregated data as the RAL's did. This is easier than the RAL 110-step procedure as well as being more accurate.

Examination of Table 1 reveals that (with the exception of Montana) the RAL-derived universe for the states is only slightly larger than the state agency intake estimated from ESARS Applicant files (total number of different applicants per year) and in the Dakotas the universe is less than intake. Labor market analysts expect the real potential population of agency clients (which doesn't match the universe of need concepts) to be about 50% larger than the size of the total intake so that RAL procedures and concepts are not useful to analysts. They also expect the poor in the universe to be twice the intake of the poor, so RAL values for poor populations also are considered unacceptable. The new universe totals obtained through MICRO tabulations are more intuitively reasonable, though the different ratios of poor and nonpoor may seem surprising. Comparison of universe poor/nonpoor with intake figures could be complex, however, since the agencies are known to have an intake pattern that is higher in socioeconomic status than the RAL universe -- the outreach programs simply don't reach the poor as well as the nonpoor blue collar workers and the lower middle class. Putting it another way, agency potential nonpoor clients, from the agencies' point of view, are quite different from the RAL's delineation of the nonpoor potential universe.

The procedures for arriving at the alternative estimates were to directly create subsets of a state's population (from 1970 1% sample) for the poor, the near-poor and the non-poor. Successive subsets were

taken of these subsets, in terms of employment status and hours worked for those in the work force and for those not in the work force, in terms of "trimming away" persons who were disabled, were students or were women with children under six years of age, to approximate the group "not in the labor force but should be" (reluctantly) left unchanged, since MICRO could not deal with non-measurable quantities any better than ratios from published figures. (As discussed below, the problem is with the concept itself.) The figures for the poor were inflated ten percent for the Census undercount, typical of the poor and minorities, and then were inflated once again by the 1970-73 percent growth in the total work force for each state. (These adjustments are not necessarily recommended, but were done to examine the magnitude of RAL underestimates for fiscal year 1974.) Then the new figures for the poor and the RAL figures for the non-poor were added together to form the total universe of need estimate.

It must be stressed that the new results obtained in Table 1 are (within a small margin of sample error) approximately the same as would have been obtained from an expensive special tabulation of the 1970 census for the Manpower Administration. The RAL's were simply attempting (unsuccessfully) to compensate for the unavailability of such special tabs. The use of MICRO was simply for economy and flexibility; it gave the same result for this data base that any computer program would have from a MICRO data base. The new universe of need estimates must be regarded as the correct estimate, within the limits of the RAL concept definitions, because they avoided the errors of interpolation that were in the RAL procedures.[6] The one advantage to RAL procedures is that they

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[6] Another problem with Manpower Administration procedures is an explosion of potential errors in sequential, stepwise procedures. Some interpolation/adjustment sequences can be up to 10 steps long. A 10 step calculation, with only 10% possible error per step, and only additive error possibilities (i.e., disregarding the real chances of multiplicative error effects) will still give a very wide spread of possible "true" values about an estimated value. If N is the estimated number, then the range could be $.9^{10}N=.35N$ to $1.1^{10}N=2.6N$. That is, for an N=10,000 after 10 steps, with a 10% error factor, the true values could be 3,500 to 26,000. One might have imagined that adjustment of "full count" Census figures is less problematic than use of samples, but this is not so. The

apply to non-Census years, while MICRO can only do tabulations on Census files, and must still be adjusted. However, another procedure is to generate a synthetic data base, which yields subpopulations on a current basis. For some kinds of synthetic data bases MICRO would also be useful.

Recommendations - Universe of Need

1. Substantive Underestimation Issues

As a result of the above findings on large underestimates of the poverty population of Region VIII, we consider it desirable to check other states' estimates by tabulations from the public use samples of the 1970 Census. If the above findings prove generally applicable, then the proportion of poverty-oriented programs has probably been too low in national manpower planning. If, on the other hand, it turns out that Region VIII and similar non-urban, low population areas are alone in the large magnitude of underestimates, the problem is not as general as it may appear.

2. Need for Revision of Concepts and Criteria for Universe of Need Estimation

Before large revisions of estimating procedures for the universe of need (or any similar estimate of populations needing services) and policy changes are undertaken, a review of the basic concepts is also in order. Discussions with Manpower Administration personnel showed major dissatisfaction with universe of need concepts. Such concepts in the universe of need as: "not in the labor force, but should be" does not correspond to the experience of labor market analysts or to economic theory. No statistical improvements will remedy the use of a questionable concept. Attempts to determine the number of workers who drop out of the labor force because of their inability to find jobs makes much

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standard error of a 1-step procedure (or the 1% public use sample) is 10% to 20%. Thus for an N=10,000, the true values would be in a range no worse than 8,000 to 12,000. If there are multiplicative errors, or conceptual flaws in the RAL procedures, the potential range of its values could be much worse. Unfortunately, the RAL procedure is only infrequently validated. Note that this footnote's analysis is merely "sensitivity analysis" of the kind often used to evaluate models of social phenomena.

more economic sense. Lack of confidence in the meaningfulness of such estimates leads agency personnel to regard it as a "numbers game," and not applicable to agency work. For universe of need actually to be a part of manpower planning, federal leadership is needed for setting up concepts that are useful as standards for planning and for program review.

A series of criteria should be applied to concepts and to estimating procedures, so that better results will be obtained:

1) Concepts of universe of need should refer to those populations whose labor force participation could conceivably be enhanced by the Manpower Administration: the poor, the unemployed, the underemployed and the trainable disabled, and the concepts should deal with total number of different persons over a year and at various points in time, not just one point in time.

2) Concepts of universe of need should not deal with those types of persons whose free choice it might be not to participate in the labor force, i.e., those included in the universe of need should want work or potentially want it, and if it is not obvious that they want work, they should not be included. The only justification for the concept "not in the labor force, but should be" appears to be an attempt to estimate discouraged workers and workers who might soon re-enter the labor force. However, methodology for estimating discouraged workers is suggested in Section 4.1 and is preferable to that used in universe of need computations.

The system for obtaining estimates should have the following properties:

1) Use of federal standards, or federal statistical work, to obtain nationally consistent definitions and estimates from state to state.
2) Adaptability of estimates to unique state or regional characteristics, or changes in same.
3) Flexibility in redefining tabulations on data to permit analysts to deal with new and different subpopulations, or demographic characteristics.
4) Use of a sound statistical framework, so that estimates can

have known accuracy levels, i.e., estimates come with standard errors and confidence levels.

5) Use of relatively current data, based on a reference period no more than two-three years old. For example, a possible solution would be linkage of the decennial census as a benchmark with periodic samples for updates and with modeling and synthetic data bases for interpolations and forecasts as outlined previously.

6) Use of a national or regional information center(s) using computerized data bases to make the first estimates - then having local areas update these data bases.

3. Applications to Manpower Planning of Computerized LMIS Methods

Any manpower agency will need to estimate how many and what kind of people need manpower services. This may not always be labelled "universe of need", but will necessitate setting up agency budget claims, initial program planning and final program review. So long as state agency people rely only on published census data, the awkward interpolations via 110-step procedures are to be expected. Such data is of limited use for planning, if there is not a way to obtain demographic characteristics of resultant subpopulations. The data are too rigid to deal with changing labor market conditions or with the needs of various groups. By contrast, survey sample data and special purpose inquiries that take advantage of "micro" data can best deal with real administrative or policy issues. Furthermore, with survey data in the computer, analysts have easy access to statistical routines to deal both with special estimates of populations and with checks on the reliability of estimates. While systems such as MICRO tend to maximize flexible inquiry, non-routine applications for non-computer people, it would still be true that the first and major advance in technique is simply the shift to any efficient computer-based inquiry against "micro" data files. Several advantages result:

1) The demographic characteristics of various subpopulations can be ascertained to give more focus to programs. Published data are incapable of representing all possible interests of analysts.

2) New statistical estimating procedures with known levels of accuracy can be developed -- the level of accuracy of RAL estimates is unknown.

3) It will be simpler to adapt estimates to changing criteria as objectives change, because users do not depend only on published tables -- analysts can generate their own special purpose tables.

4) The analysis can be straightforwardly combined with other analyses -- e.g., combining universe of need data with ESARS applicant figures to gauge program effectiveness by comparing characteristics of base populations to characteristics of clients served.

5) Data analysis would be a useful technical service for state employment services' research and analysis divisions to provide to local planners as manpower revenue sharing becomes operational.

4. Shift Current Data Bases from the Decennial Census

Starting this year and becoming worse every year into the decade, the obsolescence of 1970 figures will cause severe difficulties for state and local agencies. The use of ad hoc corrections and extrapolations to keep figures realistic leads to large uncertainties, as the experience of 1969-71 shows. Agencies require current data to be effective in dealing with needs of client populations -- needs not adequately represented in ESARS or ES202. This becomes a profoundly difficult problem under manpower revenue sharing, which requires up-to-date local planning data, but it would be difficult in any case. The extra requirements of the manpower revenue sharing approach suggest that the annual Current Population Survey will need to be expanded to give adequate sample coverage to all states and to major local labor market areas.

Expansion of the Current Population Survey is a feasible solution, short of such expensive alternatives as a mid-decade census. Since CPS is a 1 in 1,300 national area cluster sample, it is not presently adequate for local area needs; but could be expanded to provide more local detail. Given a 1970 census benchmark related to CPS, the CPS can be seen as an update to the census, with special samples of each area only once every three years, on a rotating basis among areas, and with relatively smaller samples in the off-years

(but still larger than present samples). This would hold the total cost of an annual CPS down, and still give adequate coverage of changes in state or local populations. Statistical interpolations and forecasts of state and local trends between large-sample years would be straightforward for econometricians.[7] A combined Census-CPS data base for labor market information would give the ability to have flexible inquiry systems using "micro" data. Availability of systems similar to MICRO would give sufficiently intensive use of the data to justify larger survey costs by spreading them among many users. Even without MICRO-like systems, the state Employment Service could make good use of the data for manpower planning via pre-set analytical programs. However, the same economies of scale would not result, and it might be difficult for state research and analyses departments to be sufficiently responsive as sellers of services to local planners (in the revenue-sharing framework of local choice as to where to get services). Figures 5 and 6 show the concept of a major federal role in setting up analyses of census-CPS relationships, making adjustments to the Census benchmark values and structural relations with CPS regression models, and then passing this on to states for fine-tuning and planning.

5. MICRO is Useful for Manpower Planning

This application of MICRO was not undertaken merely as a timely answer to the specific, ad hoc question, "what is wrong with these universe of need estimates?" Rather, MICRO's value can be seen in its

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[7] Without this technical approach, the present CPS would not be adequate, and an expanded CPS would be too costly. Regression analysis can be used to establish basic relationships, ratios or population characteristics to predict the probability of being in the universe of need, and also to give statistical reliability measures to estimates. In principle, this could be combined with models and data on local labor markets to forecast future manpower conditions by subpopulations. The LMIS project did substantial extra work on similar statistical estimation concepts associated with universe of need. Reliability of synthetic data bases can be treated in similar fashion. If manpower revenue sharing is realized, then a special project should be funded to conduct studies of links of the 1970 census to an enlarged CPS for purposes of state and local manpower planning.

Figure 5 Universe Of Need

SUGGESTED NEW ESTIMATION PROCEDURE

(FEDERAL ROLE)

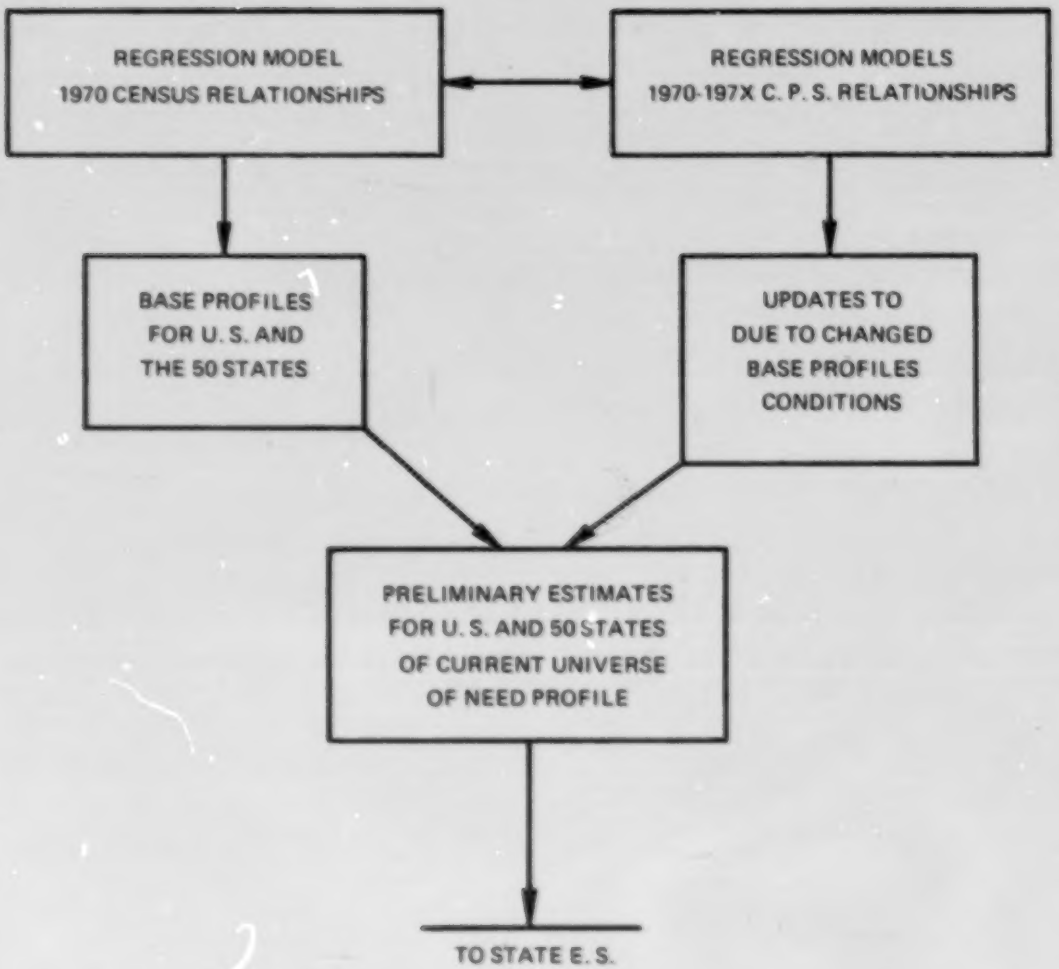
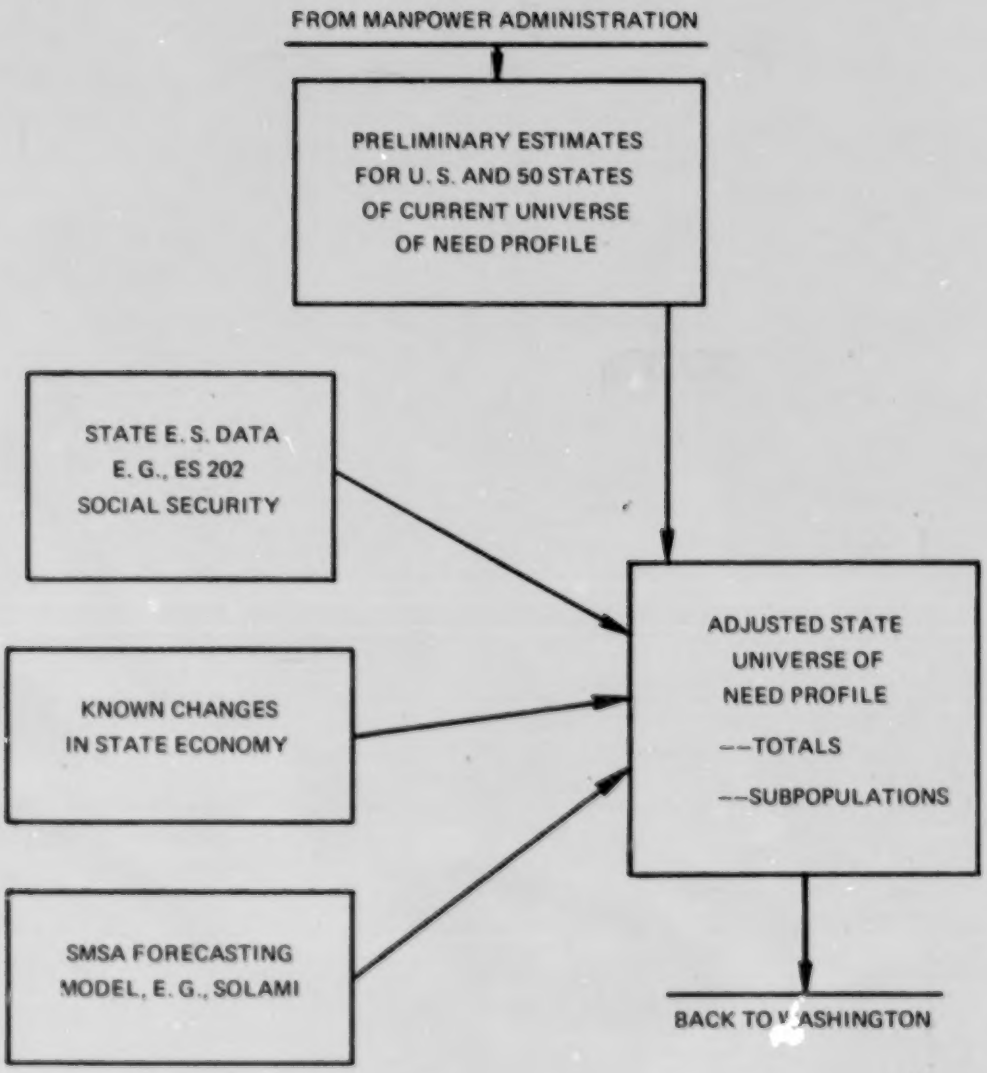


Figure 6 Universe Of Need

SUGGESTED NEW ESTIMATION PROCEDURE

(STATE ROLE)


FROM MANPOWER ADMINISTRATION
PRELIMINARY ESTIMATES FOR U. S. AND 50 STATES OF CURRENT UNIVERSE OF NEED PROFILE
STATE E. S. DATA E. G., ES 202 SOCIAL SECURITY
KNOWN CHANGES IN STATE ECONOMY
SMSA FORECASTING MODEL, E. G., SOLAMI
ADJUSTED STATE UNIVERSE OF NEED PROFILE
--TOTALS
--SUBPOPULATIONS
BACK TO WASHINGTON

economical and simple solution to what appeared to be a complex, messy problem.

1) MICRO was economical. It took half a day, and $20 to $50 worth of computer time per state to do new estimates, once the data bases were available. This may be contrasted to the cumbersome 110-step procedure of the RAL, which would take several man-days to carry out.

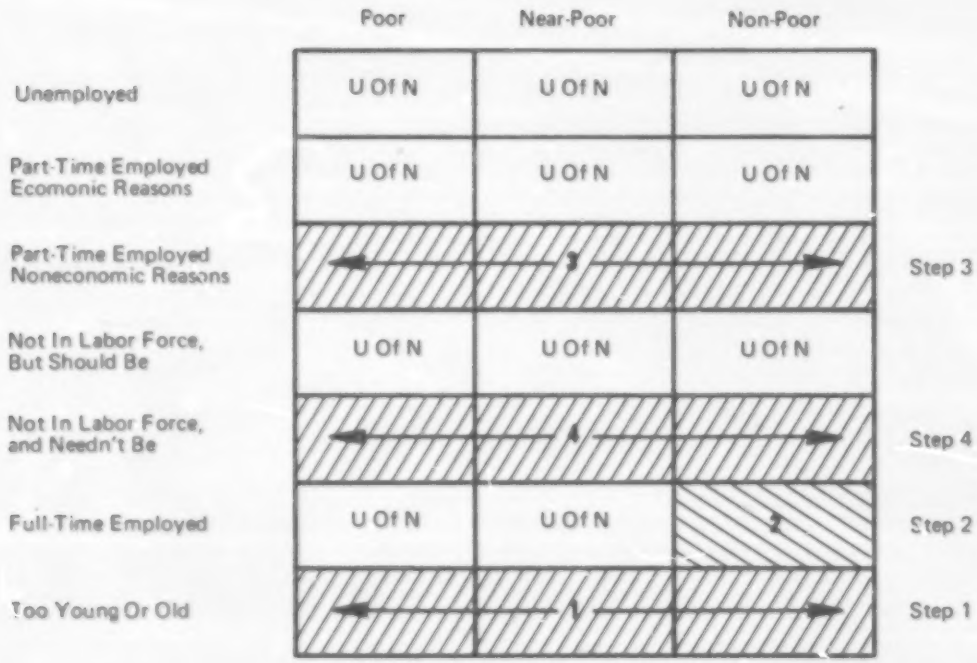
2) MICRO's language was convenient and obvious to noncomputer-oriented labor market analysts. An example of a stock type of problem for analysts that MICRO handles very well is: "identify one or more subpopulations in the data base, by using a combination of several criteria, then characterize such subpopulations by cross tabulation (or other statistics) using several more variables." Since the next criterion for subpopulations cannot be predicted, one cannot generate tables ahead of time; today the problem is interaction of poverty and being disadvantaged, tomorrow it might be being on welfare and having work experience, the next day it could be sex discrimination against women over 35.

3) Use of MICRO simplifies seemingly intractable problems with estimating; instead of 110 steps, we found the universe of need to be a simple logical process of "trimming away" categories of people who didn't fit the criteria. (See Figure 7.) The RAL procedure was to start with aggregate counts of people with different employment statuses and then to assign different proportions to poor, near-poor and non-poor. National averages can be inappropriate in a given state, and successive applications of ratios or percents give "explosive" errors. It became evident that the RAL really reduced to a table of employment status by poverty status. Thus one could "trim" away subpopulations (subsets of records):

1) Eliminate people who were too young (under 16) or too old (over 65)
2) Eliminate the combination of non-poor and full-time work
3) Eliminate the part-time for noneconomic reasons
4) Eliminate those not in the labor force who seemed to have a good reason (mothers, students, and the disabled). This is a

Figure 7 Logical Structure Of Subsets Of The Universe Of Need

(Steps In "Trimming" Subpopulations)



We start with a 1% sample of a state's entire population:

Step 1 eliminates too young or too old in a single "slice" of the total state population, cutting across poor, near-poor and non-poor.

Step 2 eliminates the group, full-time and non-poor.

Step 3 eliminates those employed part-time for non-economic reasons in a single slice.

Step 4 eliminates those not in the labor force who don't seem to fit potential participation: the disabled, students, women with children under 6. It isn't really valid, but it approximates the concept.

The remaining people are, for one reason or another, approximations to the RAL categories of universe of need. They are separated with cross-tabulations.

fiction, since there are no good criteria.

Then cross-tabulations could characterize those remaining. Upward adjustments of the figures can still be made, but with less error:

1) One could guess that 20% of students would seek summer work
2) One could guess that 20% of the disabled could be trained
3) One could make upward adjustments in totals to show population growth 1970-73
4) One could adjust figures for the poor upward 10% to compensate for census undercount.

4.5.1 Benefits

1) The substitution of MICRO estimates for a cumbersome and ill-understood 110-step interpolation procedure gave direct estimates of the universe subpopulations that improved accuracy. It showed an underestimation of poverty populations that should result in changed emphases among program items in the plan of service.

2) The procedure would result in a more equitable distribution of funds according to the specified criteria.

3) The estimates showed conceptual flaws in the research and analysis letter logic and categories very clearly with a numeric interpretation. If suggestions are heeded, it should lead to better and more credible concepts for manpower planning. At present, the RAL procedures are a "number game" to analysts, and are not used otherwise.

4) The suggested procedure for using census as a benchmark plus using the expanded Current Population Survey could be an integral part of a successful solution to problems of local manpower planning under manpower revenue sharing.

5) MICRO was demonstrated to be an intuitively meaningful and convenient tool which enabled labor market analysts to access computerized data bases.

4.5.2 Costs

1) Use of MICRO for the 1% sample of the 1970 census costs $20 - $50 per state in computer processing, and takes 1-4 hours of an analyst's

time. The old procedures took a week or more of an analyst's time. It represents a significant cost reduction.

2) The cost of bringing up a data base for such use is $2,000, but, since the data base has many uses, there is multiple cost assignment.

3) If our suggestions for use of an expanded CPS as an update to the decennial census are followed, it would give good local planning data at one-tenth to one-hundredth the cost of a mid-decade census.

Benefit-cost analysis *per se* is inappropriate because the benefits do not reduce to simple dollars only, costs are hard to assign and there are great uncertainties as to what actions will be taken.

4.6 Conclusion

The models discussed in this chapter provide a conceptual framework for viewing labor markets as well as a tool for generating quantitative estimates of certain critical characteristics of local labor markets. These models may also be used as a tool for generating synthetic data bases to fill gaps that develop as the 1970 census data becomes obsolete. The models provide practical, needed information at a reasonable cost from raw data which is generally already available. While some of the functions of the models can be reproduced manually or on other systems, the results are not as flexible and/or accurate. Such information will be vital to planning for and analyzing the needs for unemployment insurance, employment office and other services and welfare aid over the coming decade.

CHAPTER FIVE

FUTURE DEVELOPMENTS

5.0 Introduction

A number of prototype systems were developed during the Labor Market Information System Project. These systems suggest possible ways for state Employment Services, local and national manpower agencies and other producers of manpower information to improve the delivery of labor market information. The prototype projects were undertaken in three areas: projects which improved the access to existing labor market information, projects which improved the quality of existing information and projects which improved the manpower planning process by developing better manpower models.

In this chapter the following topics are discussed:

1) General benefits of an LMIS
2) Investment in an LMIS
3) Possible applications of the prototype projects
4) Gaps in current labor market information
5) Alternative information delivery systems
6) Confidentiality
7) Other recommendations

5.1 General Benefits for Integrated LMIS

Benefits of an LMIS

1) The demand for local data on labor markets is growing faster than existing procedures can handle. Therefore, a new instrument is required, but it must be cost-effective. The projection of the costs of existing piecemeal approaches carried to a higher plateau of services is likely to be astronomical, yet it is becoming politically and administratively impossible to avoid going to more comprehensive and timely information services. This feasibility study reveals a solution to these problems. The University of Michigan LMIS Project examines aspects of integrated Labor Market Information Systems and shows that new technologies

that neatly solve these problems are available. All that is missing is an organizational instrumentality to implement the technology for cost-effective solutions. Hence, we also recommend the establishment of Regional Manpower Information Services.

2) Integration of diverse labor market data bases into a single labor market information system exactly fits the intent of Title III of the Comprehensive Employment and Training Act. Significant economies are found when using the Decennial Census as a benchmark, which can be extended for local needs by use of ongoing survey samples, a few new special survey samples, and by blending in other labor market data of various agencies. Data collection and analysis are to some degree substitutable for one another. It is not necessary, for example, to carry out a Census every year if we have a good method for projecting Census information. Similarly, special purpose or multipurpose surveys can be substituted for complete counts of the universe in many applications.

3) A parallel benefit of an integrated data base is that both data gathering and data dissemination will be improved. One result may be reduction of wasteful duplication which results from a number of groups obtaining data from the same employer. Even worse, employers provide information and cannot get it summarized to meet the needs of other agencies. For example: the Equal Employment Opportunity Act requires a high degree of detail from employers on such matters as labor market conditions and the frequency of minority placements and promotions. In fact, it requires a degree of detailed information that exceeds what an Employment Service does by way of analysis or dissemination. Some of this burden should be shifted from firms to the government, aiding both the private and public sectors. Similarly, both dissemination and the encouragement of interagency cooperation can help to overcome mutual lack of knowledge on data sharing among agencies.

4) Increasing labor market information could reduce unemployment without increasing inflation. Holt [9].

5) The Employment Service could do a profile of jobs based on its job bank file and compare this profile with jobs held by members of the community using one of the non-Employment Service data bases. Similarly,

the ESARS applicants would be compared with all workers in the community. The Employment Service could improve its image by advertising that they have so many jobs paying over $3.00 per hour or that they have applicants with certain characteristics.

6) The data bases can serve to provide information that is useful to program planning or universe of need computations. If the information is not in one data base it can usually be inferred from the data bases taken together. For example, if one wanted the characteristics of Negro workers one could get the best earnings information from social security records. However, Census information would be more reliable as to total number of persons.

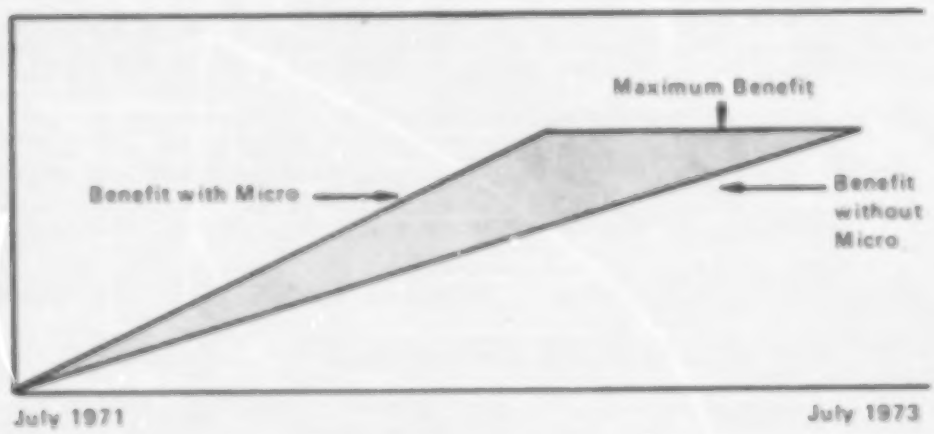
7) The inconsistencies among the data sources are a constant source of frustration to manpower planners. The Bureau of Labor Statistics publishes two different employment series based on establishment employment and a household survey. They have tried to reconcile the series with varying success. However, many agencies produce data which are never reconciled with other agency data especially at the SMSA level. The flexibility afforded by the MICRO approach, an integrated data base and the MICRO retrieval method permit manpower planners to reconcile differences in the data. For example, social security tabulations will indicate differences in employment counts due to multiple job holding. The MICRO language permits asking questions about possible ways in which data could be reconciled. For example, self-employed persons could be removed from the Census to permit comparison with the ES202 tabulations.

8) Quality control is a serious problem in the production of statistical or management reports. Any error from the collection to the final printing of the report can result in a loss of confidence in the report. This loss of confidence means that analysts and managers will refuse to use the report. They will instead use their own manual system or guesstimates which are far inferior to the information that could be produced by the computer system if reliable.

This is a serious problem, especially with multi-million dollar computer systems. Even if the errors in the system are eventually diagnosed, there is a loss of confidence in the system which can extend beyond the time the errors are diagnosed. A computer system like MICRO can be designed to cut down on the time it takes to diagnose the errors and instill confidence in the users of the system. If the system is of no value until these errors are corrected, the minimum savings represented by MICRO is the cost of the old computer system per month times the number of months MICRO reduces the time to debug the other computer system. The actual savings can be considered to be the value of the new computer system per month times the number of months MICRO reduces the time to debug the other system.

In general, Figure 8 illustrates the true savings represented by a system like MICRO on the assumption that a new computer system is not totally ineffective when it is first installed.

Figure 8 Benefit Of Computer System With And Without MICRO In Dollars



The shaded area in Figure 8 represents the benefit of a MICRO-type system. It is possible that errors in the system may never be diagnosed. There is presumably some cost in wrong decisions based on the incorrect information. This, too, can be measured by Figure 8.

9) Manpower program planners often want a specific question answered. Examples of such questions include the count of veterans served by the employment service, supply of male black college graduates with an income under $10,000 in an SMSA, etc. Often the reporting systems do not produce tabulations to answer the specific question, but MICRO-type systems can produce answers if the raw data has been collected, is in the information system and is reliable. With answers to these questions, better programs can be planned and resources can be allocated more effectively.

10) Data bases like ES202 can be combined with an occupational-industry employment matrix to predict employers most likely to have certain jobs for certain occupational groups. This could be a tremendous aid to job development.

5.2 Investment in a LMIS

The accompanying table entitled, "Investment in Software Systems," demonstrates the phenomenon of "economies of scale" as applied to labor market information. There is a trade-off ranging from little or no data preparation with little initial investment to a fairly large initial investment. However, the cost per inquiry is significantly lower after the large initial investment has been made. If cost, not time, is the only consideration, the table suggests that if only a few queries are made in the lifetime of a data base, it pays to make only a moderate investment in software capabilities. However, this produces a system which is "locked in" since there is no access to data except through technically trained programmers, so response time will not be fast, and the agency absolutely cannot afford to shift to a high use level with a high cost per 100 queries. This is typical of traditional systems which discourage nonstandard inquiries. In order to go to high inquiry levels (e.g., for job placements or for a regional data center), it pays to make an initial investment to lower unit costs substantially, and to permit more sophisticated queries. At the same time the elimination of programmers gives further gains. (On the other hand, if an agency miscalculated as to the ultimate worth of a particular data base, the

TABLE 2

INVESTMENT IN SOFTWARE SYSTEMS

ILLUSTRATIVE SOFTWARE COSTS TO ACCESS DATA

Stage of Data	One Time Cost to Prepare Data	Computer Cost/Inquiry	Programmer Cost/Inquiry	Cost per Inquiry			
				1 Inquiry	10 Inquiries	100 Inquiries	1000 Inquiries
Raw Data From Goverment Agency (Traditional System)	$1000.00	$1000.00	$1000.00	$3000.00	$21000.00	$2010.00	$2001.00
Data in Blocked Binary Tape	$2000.00	$100.00	$1000.00	$3100.00	$1300.00	$1120.00	$1102.00
Data in MICRO Format	$3500.00	$2.00	0	$3502.00	$352.00	$37.00	$5.50
Data in MICRO Crosstab Format	$3600.00	$.50	0	$3600.00	$360.50	$36.50	$4.10

resulting low use level would not justify costs.) The more retrieval an agency wants to do, the more a MICRO-like system is cost-justified. The Table is intended only to illustrate economies in the operating cost of a sample software package. Additional economies in hardware are also possible with increased volume. The actual costs, of course, depend on the size of the data base, nature of the inquiry and complexity of the request. If multiple inquiries are made at the same time, the cost of the second inquiry is considerably below that of the first inquiry since the first inquiry includes the overhead cost associated with loading the system. If several data bases are similar, the one-time cost to prepare data can be allocated among the data bases. For example, while it would cost $3,600 to prepare data in a MICRO cross-tabulation format for one month, the cost for each subsequent month might be only $600.

5.3 Applications of Prototype Systems

The LMIS Project has demonstrated the usefulness of several prototype information systems:

5.3.1 MICRO Information System

Millions of dollars are spent every week on the generation of labor market data by the Department of Labor, Department of Commerce and State Employment Agencies. This data is used to generate reports which encompass only a small fraction of the possible reports which could be issued to meet the needs of manpower planners, Employment Service counselors, job seekers, employers and manpower agency administrators. The MICRO computer language was developed as a prototype system to test the feasibility of increasing the value of currently generated labor market information by improving the technology by which data is converted into information.

In the process of testing the prototype, some information gaps were uncovered which could not be met with existing labor market data. These gaps are discussed in later sections of the chapter. However, many needs were uncovered which were not being met because the computer technology being utilized was not adequate to do the job.

Employment Services cannot respond to the information needs for planning for one or more of the following reasons:

1) The cost of tabulating labor market information for special uses is high,
2) Since individual programs have to be written to meet special requests, time delays are often too long to meet needs,
3) Data processing staffs of most state employment agencies are not trained to respond to special-purpose user requests,
4) Data prepared for one purpose is often not sufficiently documented for other purposes.

The proposed alternative is for government agencies to design data bases which could be utilized for a number of information needs. The cost of designing data bases rather than tabulating data for single reports may be 20-25% higher than the cost of the original reports, but the cost of subsequent reports may be 85-90% lower than the costs which would now have to be incurred. Data bases could be accessed by non-programmers using a computer language such as the MICRO language prototype. Not all labor market information generated by state and federal government agencies need be stored in the data base. Not all state agencies would have to have their own information retrieval language. Regional centers could service smaller states using a time-sharing computer.

The first step is a policy statement from the Manpower Administration in Washington recommending this alternative. The second step is a study of alternative commercial and noncommercial systems for meeting the needs of users of labor market information.

5.3.2 Improving Data Quality

Currently the collection of labor market information is designed for the one-time report or use. If data bases receive more frequent use, they require more careful preparation. Various computer techniques can be used to improve the quality of the data bases. Computerized plotting routines can be employed and better editing techniques and other data quality checks should be used. These services can best

be offered by a regional center or the Bureau of Labor Statistics.

5.3.3 Synthetic Data Base

Several models were developed, using primarily time series data, to forecast different employment, labor force series, unemployment insurance and welfare data bases. The forecasting procedures can also generate estimates of the series for periods when the data are not collected. For example, in most SMSA's labor force estimates by age and sex are available only for census years. Our LMIS model generates quarterly estimates for this series through the 1970's. Further research in labor market models can provide an alternative way of estimating data that is of use to manpower planners.

5.3.4 Special Purpose Projects

A few special purpose projects were carried out to meet the needs of particular users of labor market information. For example, employers need labor market information on minority employment by occupation to use as a guide for their own utilization of minority employment for their areas. Tabulations and analysis of EEOC data suggests EEO-1 data should continue to be tabulated and made available for this purpose. A directory of employers was prepared for use by Employment Service Counselors in Denver, Colorado. Similar directories listing two years of job orders cross-classified by occupation could be prepared for other areas. The cost of preparation of such directories could be reduced if employers were assigned a uniform code for all job orders and transactions; this would result in a more concise and more useful directory. The directory can be a useful aid to job development.

5.3.5 Computerized Aid to Counseling

Counselors in the Youth Opportunity Center in Denver were able to use a prototype on-line real-time information system developed by the LMIS Project to make inquiries about possible job openings in the Denver area. The cost of developing and making such a system available

for only one local office could not possibly be justified by a cost-benefit calculus. However, if such a system were to be used in 20 or 30 offices there would be a dramatic reduction in unit costs. The staff cut at YOC, combined with only a few months of actual use of their terminal, made it nearly impossible to make any estimates of actual effects of the project on counselor productivity or placement quality. During 1974 the Institute of Labor and Industrial Relations has a contract to test the use of such an on-line system in a full-service office of the employment service. In such an environment an attempt to measure the effect of the technology on the quality of placements will be undertaken. Such an experiment consists of two offices: a control office, and an office provided with a terminal to access an on-line information system for furthering this goal. Follow-up information will be collected on placements in these offices. Other data will also be used to standardize the effect of the on-line system.

5.4 Data Gaps and Weaknesses in Labor Market Information

As the 1970 Census of Population grows out-of-date, the need for current information for use by manpower planners increases. There are several ways to meet this need:

1) conduct the Census more often than every ten years,
2) use administrative data to update the Census,
3) carry out special surveys to remedy information gaps and
4) build models to generate estimates of needed information.

The experience of the LMIS Project is that a combination of the above methods can serve very effectively to remedy information gaps in information between Census years.

The most serious existing gaps in labor market information that require new information sources are:

1) There is a need for occupational employment information by geographical area. The Occupational Employment Statistics Program promises to fill this gap, but it is underway in less than half of the states and only about half of that number have published data from the program. It would be interesting to experiment with Social Security

data as a source of occupational information. Social Security records currently permit identification of industry, establishment, county, age, race, sex, earnings and employment. Such an experiment would add occupation to the form and evaluate the quality of the response.

2) There is a need for information on the characteristics of persons in need of manpower services by geographical area and by labor supply. The current universe of need procedure generates such data, but it has been found to be inaccurate and there is no procedure for validating the method on an ongoing basis. This problem was discussed in Chapter 3. One of the most serious criticisms of existing data on universe of need is that we cannot say with any degree of certainty whether Manpower Programs improved on the universe of need or had no effect at all for almost any area in the country. While Chapter 3 suggests that improvements in procedure are needed in computing the universe of need, there is still a need for additional survey information on characteristics of persons who are unemployed or who might other wise require manpower services.

3) Data on occupational wage rates are not adequate for the many uses for which they are required. Associated fringe benefit costs often are not available. Data published in industry wage surveys may be five or six years old. Geographic detail is often limited. A new BLS Program will provide wage and fringe benefit data by industry and occupation. However, this data will not be available for two years and when it becomes available, it will only provide data on eight or nine broad occupational groups. Firms deciding where to locate a plant, workers deciding on jobs, government regulatory agencies and parties to collective bargaining would benefit from such detailed data available on a more timely and comprehensive basis.

4) Data on mobility, migration and commuting are also needed. The Decennial Census provides this information. Social Security records provide information on industry and geographic migration of workers. Little is known, however, about commuting patterns, migration of the unemployed or mobility of welfare or low-wage workers into and out of the

labor force for specific SMSA's other than information available from the 1970 Census.

5) Follow-up information on persons who have used Manpower Programs is needed. We do not know whether a person who does not return to the Employment Service does so because he has obtained a good job or because he had a bad experience at the employment service. We know very little about the quality of placements. We also need follow-up information on persons trained by Manpower Programs. We should spend more money developing these types of data sources rather than financing exhaustive attempts to tabulate the characteristics of employment service applicants.

6) Supplemental labor market information on jobs not listed at the Employment Service would be a useful catalog for job seekers. The Employment Service lists only 15-25% of most job vacancies. Often these jobs are the lowest paying, least desirable jobs. One possibility would be the use of ES202 data for job development purposes. Applying an industry-occupational matrix to this data base would provide a source of possible job leads for many occupations.

7) Projections of occupational supply and demand are made by state and local educational and manpower planners, private research organizations and the U.S. Department of Labor. However, many of these programs do not provide local planners with the detail and accuracy they require. Certain fields require separate studies; for example, applying the BLS procedure to a state or other area may not give an accurate picture of demand and supply of physicians and other medical professions.

8) Vocational Education Data. Data is very limited on vocational education enrollment, graduation and characteristics of trainees, especially in the private sector.

Our experience suggests that any models, synthetic data bases or other procedures for generating the above data will result in less than fully satisfactory results without additional new information.

Appendix K talks more about users and needs of labor market information. Appendix L describes current labor market sources. Appendix J discusses limitations of the MICRO data bases studied.

5.5 Alternative Information Delivery Systems

There are two major alternatives for delivery of labor market information. The first alternative is the design of exportable programs to be sent to each state Employment Service. The second alternative is the development of major centers to do data processing, retrieval and dissemination of labor market information.[1]

Some data processing functions, such as processing unemployment insurance claims, are best carried out by states. Other functions, such as preparation of prepackaged census tabulations for use by manpower planners, are best handled by national centers. Computers are like a utility: if a number of needs can be met by one center, the per unit cost can be substantially reduced. On the other hand, diseconomies of scale result if centralization leads to loss of state control over the quality of data.

There are three primary justifications for the government rather than a private concern taking the role of providing labor market information. First, there are economies of scale in the collection and dissemination of information analagous to utilities. Second, much of the information is collected as a result of government programs such as Census, Social Security and Unemployment Insurance which cannot by law be turned over to private individuals. Third, individuals who need the information most, such as the unemployed or administrators of manpower programs, could not easily pay private individuals for the information.

A few regional data centers set up to train and service state and regional manpower planners would be much more cost effective than trying to increase the size and capabilities of the data processing and research staffs of all fifty states. (See Appendix G)

The function of such a regional center would be the development of

1) Manpower planning and forecasting procedures,

2) Unemployment claims forecasting procedures,

3) Information collection priorities,

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[1] In this section we assume the government rather than private enterprise will be providing the labor market information.

4) Data base design (including synthetic data bases),
5) Special services to meet the needs of the participating agencies,
6) Research in collection, analysis and dissemination of labor market and manpower information and
7) Teaching, including seminars, conferences and graduate education programs.

The LMIS Project has designed prototype technologies which would work best in a large regional center for manpower information. Most state data processing staffs do not have the expertise to support mathematical programming or advanced retrieval languages. The cost of disseminating these products to 50 states far exceeds the cost of disseminating them to a few regional centers.

Computer systems and programs which are currently disseminated by the Manpower Administration are designed and constructed to operate on any of the computer systems used by the various state employment services. The vehicle for this standardization is the writing of computer programs in ANSI (American National Standards Institute) COBOL (Common Business Oriented Language). COBOL, as the name implies, was designed as a business data processing language. Such a specialized language is not suited for scientific programming, operations research, simulations or information storage and retrieval for large volumes of micro data. A data retrieval language written in COBOL is extremely expensive to develop and grossly inefficient to operate. One of the reasons for the limited analytical capabilities of several state research and analysis sections is that the use of regression packages, simulation models and information retrieval systems is not possible since they cannot be efficiently and effectively written in COBOL. Since they cannot be standardized to the degree required by the Manpower Administration, they cannot be encouraged. Regional centers would remove this constraint as they could have facilities for analytical capabilities.

5.6 Confidentiality

The irony of on-line retrieval systems is that the confidentiality of the respondents can be more secure than under more traditional batch systems. Since low cost tabulations or analyses can be provided to other

government agencies, the need for government agencies to exchange micro records is diminished. This should lessen the risk of disclosure.

The technology is quite adequate to safeguard privacy. Some of the safeguards that can be taken, approximately in order of increasing cost, are:

1) Secret passwords to sign onto a computer
2) Secret passwords typed automatically by a terminal for a computer to recognize the terminal as authorized
3) Secret passwords to access a computer file or part of a computer file
4) Secret passwords to unscramble information in a computer file
5) Restriction of computer use when confidential information is being processed
6) Security personnel assigned to computer operations
7) Special data transmission devices to scramble transmission of data
8) Physical destruction of tapes and data cells after confidential information is processed.

We have found level three to be secure enough relative to cost, but in some circumstances have incurred the extra cost of scrambling information.

5.7 Other Recommendations

1) Long-term planning should be adopted for Manpower Administration information needs. The goals of this planning should be consistency and cost-effectiveness through the development of new capabilities and the improvement of old practices (as well as integrating the two), and the integration of local, state and nationwide information system development. Such long-term planning should include five-year funding programs with sufficiently firm commitments to allow for continuity and consistency among a wide variety of research and development efforts.

2) Training programs are essential for the intelligent use of an LMIS. This includes training analysts who will use the system as well as systems personnel who will support it.

3) More use should be made of sample surveys and less reliance should be placed on attempts to survey all applicants. For example, if trained personnel interview a sample of manpower program enrollees, the results would be much more satisfactory than attempts to obtain the data by program people who tend to treat the data collection as an obstacle to their primary objectives.

4) There is a need to continue work on uniform concepts and codes, such as employer numbers for the different LMIS data bases. For example, employer records from different data bases have many different identifications. ESAR's job orders have a unique numbering system. EEO-1 has the employer Social Security number. BLS-790 has BLS number. ES202 has its own employer number. Similar discrepancies exist in definitions of data elements. Differences in concepts should also be reconciled to whatever extent possible. Attention must also be paid to the sample size which will be adequate for different uses of the information. Finally, reconciliation between the dictionary of occupational titles and the census occupation code should be part of the information system.

5.8 Policy Conclusions

The Labor Market Information System Project (LMIS) was designed to evaluate the need for new labor market information and for methods of making better use of currently collected statistical administrative data. The project developed various information prototypes which could improve the delivery of labor market information.

It is unlikely that many of our prototypes will be adopted by most state agencies. This does not reflect a disinterest on the part of the states. It rather reflects the large fixed costs involved in implementing the prototypes. These fixed costs can be spread much more economically if the prototypes are implemented by regional centers.

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